JT8D-1, -1A, -1B, -7, -7A, -7B, -9, -9A, -11, -15, -15A, -17, -17A, -17R, AND -17AR TURBOFAN ENGINES

MAINTENANCE MANUAL

PART NO. 481671

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INITIAL ISSUE DATE

DECEMBER 15/62

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This manuals and blueprints are not meant to be used for current update material for certification / repair, but make an excellent reference for the scholar, collector, modeler or aircraft buffs .... For proprietary reasons we generally only provide civil manuals and blueprints on long-out-of-production Aircraft / Engines / Helicopter. The information is for reference only and we do not guarantee the accuracy or currency of any manuals.

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UNITED TECHNOLOGIES
PRATT & WHITNEY

Printed in United States of America

SERVICE BULLETIN LIST--

The intent of each Service Bulletin identified below which is of a repetitive nature has been incorporated in this manual. ONE TIME changes are assumed to be accomplished in accordance with the applicable bulletin instructions and are consequently not considered of maintenance manual significance.

238
678
745
808
844
862
875
876
938
939
982
992
1011
1016
1057
1111
1122
1132
1134
1142
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1647
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1758
1949
2089

SERVICE BULLETIN LIST--

The intent of each applicable Service Bulletin below has been incorporated in the publication beginning Oct 15/69.

SB NO.	DATE INCORP	SB NO.	DATE INCORP
1957	12-1-71	5390	9-1-82
1995	6-1-73	5422	9-1-84
2016	8-1-79	5425	9-1-83
2223	6-15-71	5455	9-1-83
2240	10-15-69	5465	9-1-83
2244	3-15-70	5502	1-1-85
2338	3-15-70	5592	9-1-85
2461	3-15-70	5639	5-1-86
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3281	2-1-76	5706	1-1-87
4087	2-1-74	5718	5-1-87
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4129	11-1-73	5872	5-1-90
4218	2-1-74	5880	5-1-91
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5207	2-1-82	6392	5-15-01
5250	8-1-81	6424	10-15-02
5297	2-1-82		

LIST OF EFFECTIVE SECTIONS

The current date levels of Lists of Effective Pages in this manual are specified in this List of Effective Sections. Revised or added sections for this revision are indicated by an "R" mark.

This List of Effective Sections records not only the dates of sections revised or added in this revision, but also the dates of all other List of Effective Pages remaining in the manual that are not revised or added. If there is a question about the correct date level of a section in this manual, it is recommended that all Lists of Effective Pages be examined to see if they have the correct dates as specified below.

R		How To Use
R	70-00	Standard Practices
	72-00	72 - Engine
	73-00	73 - Fuel
R	74-00	74 - Ignition
	75-00	75 - Air
	77-00	77 - Engine Indicating
	79-00	79 - Oil

How To Use

	LIST OF EFFECTIVE PAGES
	HIGHLIGHTS
	TABLE OF CONTENTS
	INTRODUCTION • General • Supplementary Publications • Parts And Service • Ordering Parts • Returning Parts • Vendors • Explanation Of Manual Format • Explanation Of Manual Format Corporate Trademarks • Explanation Of Manual Format

INTRODUCTION

1. General

This publication is compiled and issued by the Customer Services Department of Pratt & Whitney, Division of United Technologies Corporation, East Hartford, CT 06108-0969 USA. This manual, as it may be supplemented by P&W service bulletins, constitutes the authoritative statement of Pratt & Whitney approved and recommended maintenance procedures normally performed on the line or in the hangar, for the JT8D Engine as installed in the aircraft.

The information and instructions contained herein are based upon actual experience acquired under varied and exacting conditions. The utmost in dependable engine performance will be gained by conforming to these instructions.

Unusual problems concerning engine maintenance should be presented to the Customer Services Department either through its field representatives or by direct contact. All possible assistance will be provided toward the solution of these problems.

Requests for pertinent information not covered in this publication, and suggestions for modification or amplification of these instructions so as to increase their usefulness, will be welcomed by the Pratt & Whitney Customer Services Department.

This publication will be revised as necessary to incorporate the latest approved data.

2. Supplementary Publications

It is recommended that personnel concerned with engine maintenance also familiarize themselves with the following publications:

Engine Manual -	Part No. 481672
Accessory Components Overhaul Manuals -	Various
Illustrated Parts Catalog -	Part No. 481675
Engine Overhaul Standard Practices Manual -	Part No. 585005

INTRODUCTION

Service Bulletins - Service Bulletins will be issued as required to provide information or instructions for modifying earlier production engines or parts to the latest configuration.

Support Equipment Numerical Index - The Part No. 760092 Support Equipment Numerical Index lists all P&W special tools, cross-referenced against manual location, engine model effectivity, and maintenance requirement. This index, when used in conjunction with the maintenance manual and the P&W Support Equipment master data sheet aperture cards, provides the operator with greater self-sufficiency in logistics planning and in the technical aspects of special P&W support equipment.

The Part No. 760092 Index has the support equipment necessary at all maintenance levels. On request an alternate index, Part No. 808987, is available which has the support equipment for maintenance levels "A1" through "B2", and "T1".

JT8D Oil Monitoring Guide - Part No. 821432
This guide describes the insp ections and tests that you can do to the engine oil to find if there is something that you should do before it leads to an untimely removal of the engine. This guide will show various inspections and tests, in its own section that will identify and describe each, as well provide information as to the results that will be found and how to understand them to best maintain the engine. For this purpose the guide also includes tables and illustrations that give guidelines or samples of "limits" used in the field for various analysis techniques.

3. Parts And Service

Customer Services Department - Pratt & Whitney maintains a Customer Services Department to assist its customers in the operation, maintenance, and overhaul of Pratt & Whitney engines. Customer Services Department representatives maintain contact with operators and engine service activities and are available operators or the investigation of any specific difficulty or problem. Any request for assistance should be addressed directly to the Customer Services Department, Pratt & Whitney, East Hartford, CT 06108-0969 USA.

4. Ordering Parts

Whenever possible, refer to the Illustrated Parts Catalog, Part No. 481675, when ordering parts. In case a parts list is not available, give engine model, manufacturer's engine serial number, and a full description of the part and where it is used. All spare parts orders should be addressed directly to the Commercial Parts Support Department, Pratt & Whitney, East Hartford, CT 06108-0969 USA.

Because some parts require special or expensive equipment for assembling and cannot be fabricated except in a specially equipped shop, they are not furnished individually and must be purchased as assemblies. If an order is received for a unit of an assembly coming under this classification, the complete assembly will be shipped.

5. Returning Parts

All material being returned for investigation is to be shipped to the address that follows:

USA Based Operators	Non-USA Based Operators
PRATT & WHITNEY	UNITED TECHNOLOGIES INTERNATIONAL
Receiving Well #5	c/o PRATT & WHITNEY
Customer Parts Return	Receiving Well #5
(D Bldg, Col G1-15)	Customer Parts Return (CPR)
Service Material Investigation	(D Bldg, Col G1-15)
400 Main Street	Service Material Investigation
East Hartford, CT 06108-0969	400 Main Street
USA	East Hartford, CT 06108-0969
	USA

Material returned is to be accompanied by a number five (5) Request For Support Allowance (RAS) copy.

R
R

INTRODUCTION

Parts must be packaged adequately to prevent damage in transit. Parts removed from various engines or having different part times should be individually tagged and covered by separate RSA's.

Material, eligible for Service Policy Benefits and returned to Pratt & Whitney Eagle Services, Cheshire Engine Center, is to be shipped to the address that follows:

	USA Based Operators	Non-USA Based Operators
R	PRATT & WHITNEY AFTERMARKET	UNITED TECHNOLOGIES
R	SERVICES	INTERNATIONAL
R		c/o PRATT & WHITNEY AFTERMARKET
R		SERVICES
	Cheshire Engine Center	Cheshire Engine Center
	500 Knotter Drive	500 Knotter Drive
	Cheshire, CT 06410	Cheshire, CT 06410 USA

NOTE: Material returned is to be accompanied by a number five (5) copy of an RSA. Material so returned should be covered by the operator's charge purchase order to facilitate proper billing.

6. Vendors

Vendor Services - The names of any companies provided in this publication as a possible source for required services or supplies are furnished for information purposes only.

IT IS TO BE UNDERSTOOD THAT PRATT & WHITNEY DOES NOT ENDORSE THE WORK PERFORMED BY THE COMPANY OR COMPANIES NAMED HEREIN OR ANY OTHER COMPANY AND DOES NOT ACCEPT RESPONSIBILITY TO ANY DEGREE FOR THE SELECTION OF SUCH COMPANY OR COMPANIES FOR THE PERFORMANCE OF ANY WORK OR PROCUREMENT OF SUPPLIES.

EQUIVALENT TOOLS, FIXTURES, TEST EQUIPMENT AND CONSUMABLE MATERIAL

In accordance with federal regulations (14CFR43.13), anyone performing work on an engine covered by this manual under the jurisdiction and authority of the Federal Aviation Administration (FAA) must use tools, equipment and test apparatus which will assure that such work will be completed in accordance with industry standards. If Pratt & Whitney recommends special equipment or test apparatus, each person performing the work must use that equipment or apparatus or its equivalent that is acceptable to the Administrator of the FAA. Special provisions of the FAA regulations regarding tools, equipment and test apparatus apply to holders of certain air

carriers operating certificates and certificates issued under certain specified parts of those regulations.

7. Explanation Of Manual Format

WARNING: BEFORE YOU USE ANY OF THE MATERIALS SHOWN IN THIS PUBLICATION, YOU MUST KNOW ALL OF THE PRECAUTIONS RECOMMENDED BY THE MANUFACTURER OR THE SUPPLIER. THESE PRECAUTIONS TELL YOU HOW TO:
- USE THE MATERIAL SAFELY
- KEEP THE MATERIAL SAFELY
- DISCARD THE MATERIAL SAFELY
IF YOU DO NOT OBEY THE RECOMMENDED PRECAUTIONS, YOU CAN GET AN INJURY OR BECOME SICK.

Equivalent consumable material substitutes may be used for listed items.

Safety Cable: Safety cable is permitted at limited locations as an alternate to lockwire. Install safety cable by PWA Specification 316 (see the Standard Practices Manual, Section 70-53-00). Safety cable is permitted at all external and fan stream locations where the lockwire hole is sufficiently large for the cable, except as specified below. Use safety cable PN AS3510 -0218C (0.032 inch diameter) and safety cable ferrule PN AS3510 -02F.

Do not use safety cable at these locations:

Locations where the lockwire hole is more than 0.100 inch diameter (the safety cable ferrule will pull through a hole larger than this).
Internal engine, gearbox, and accessory areas.
Heat shields (as lacing).
Vendor-controlled (Category 1) components.

8. Explanation Of Manual Format Corporate Trademarks

The following words, acronyms, or designs are trademarks of United Technologies Corporation.

See Figure 1.

9. Explanation Of Manual Format

A. Specification

This manual has been prepared in accordance with ATA Specification No. 100 as established by the Air Transport Association of America.

B. Standard Numbering System

As required by ATA Specification No. 100, an element numbering system is used. At the lower outside corner of each page this element code number will appear. The first element is the chapter number, identifying and locating the instructions within the airframe manual. The second element designates the subject breakdown in the chapter. How the elements have been assigned to the various assemblies and subassemblies of the engine will be readily apparent from a consideration of the Table Of Contents.

The element numbering system employed in this manual corresponds with that employed in the Engine Manuals and the Illustrated Parts Catalog.

C. Chapter Responsibilities

In cooperation with the aircraft manufacturers, Pratt & Whitney furnishes, or contributes to, the following chapters in the airframe manuals:

Chapter	Title	Maints.	Engine	Illustrated Parts Cat.	Standard Practices
70	Standard Practices	X			X
72	Engine	X	X	X	
73	Engine Fuel and Control	X		X	
74	Ignition	X		X	
75	Air	X		X	
77	Engine Indicating	X		X	
79	Oil	X		X	
		Overhaul			

INTRODUCTION

Pratt & Whitney assumes sole responsibility for Chapters 70 and 72. Chapters 73, 74, 75, 77 and 79 are chapters of shared interest, prepared by the airframe manufacturer. Only the Pratt & Whitney contribution to each shared chapter is included in this Manual.

D. Abbreviations

The use of abbreviations has been avoided as much as practical in this manual. In some instances however, such consideration as space limitations, common usage, etc., have made the use of abbreviations preferable to the use of the applicable longer terms. Abbreviations used are defined below:

AMS	Aerospace Material Specification
ANPT	American National Pipe Thread
approx.	approximate
Assem	assemble
Assy	assembly
ATA	Air Transport Association
C	centigrade
ccw	counterclockwise
CG	center of gravity
CSD	constant speed drive
dia	diameter
Dim	dimension
F	fahrenheit
F/D	fan discharge
FIR	full indicator reading
ID	inside diameter
in.	inch
KTS	knots
lb-in.	pound-inch
LH	left hand
matl	material
max	maximum
min	minimum
No.	number
OD	outside diameter
PD	pitch diameter
pph	pounds per hour
psi	pounds per square inch
psia	pounds per square inch absolute
psig	pounds per square inch gage
P&W	Pratt & Whitney
ref	reference
RH	right hand
rpm	revolutions per minute

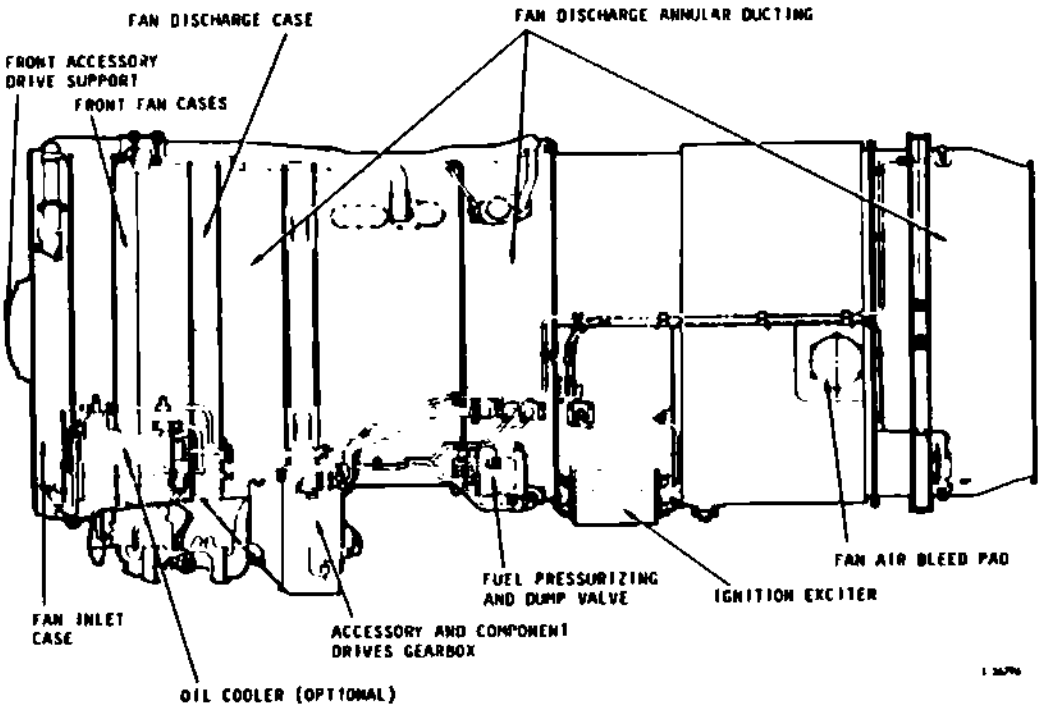
(CONTINUED)

SB	Service Bulletin
sq-ft	square feet
thd	thread

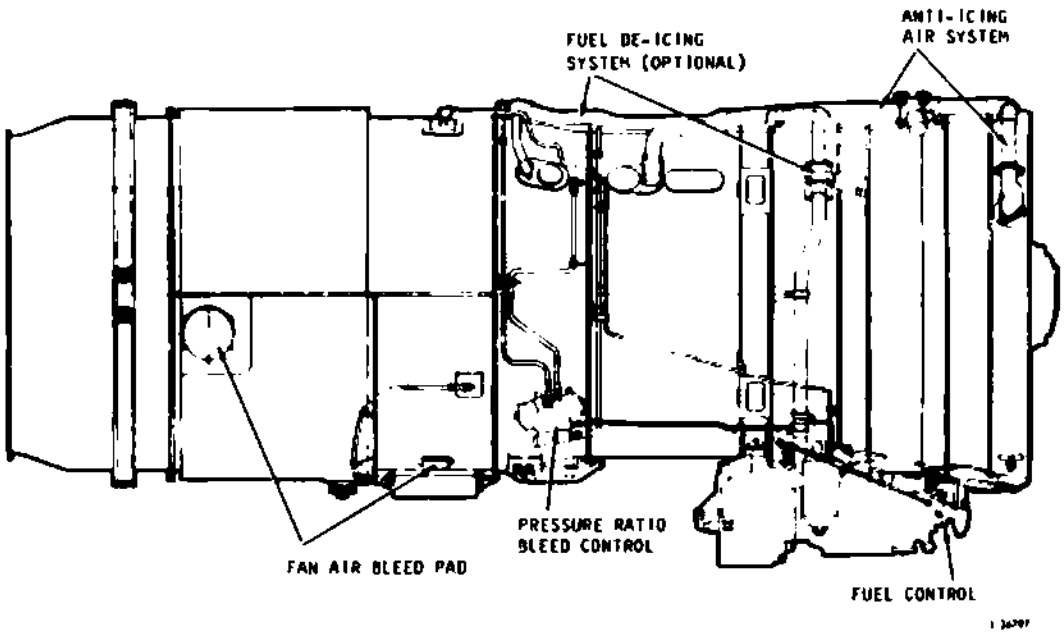
Abbreviations

L-75686 (1287)
PW V

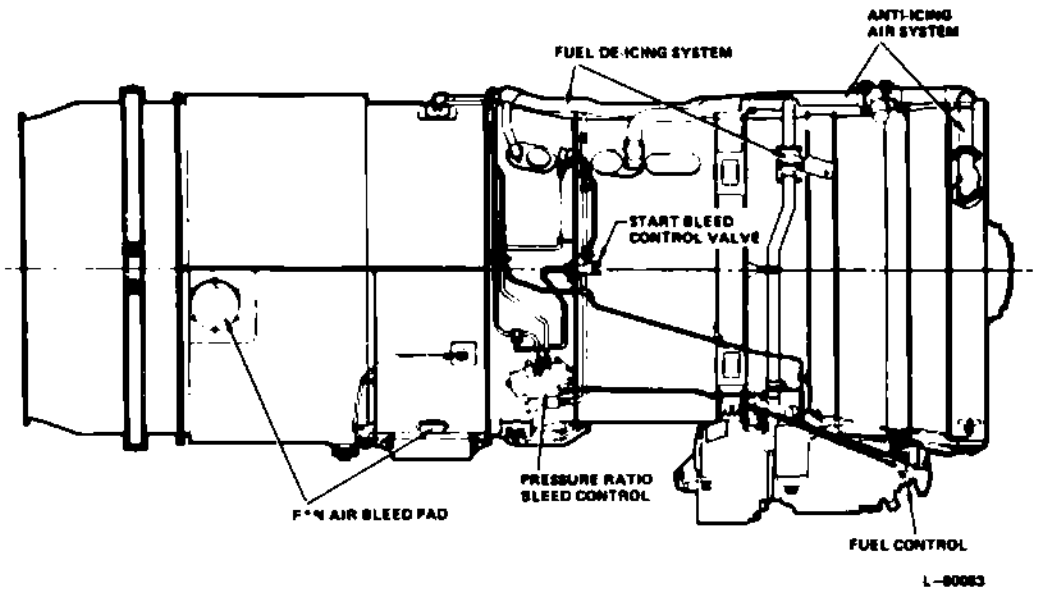
Corporate Trademarks
Figure 1



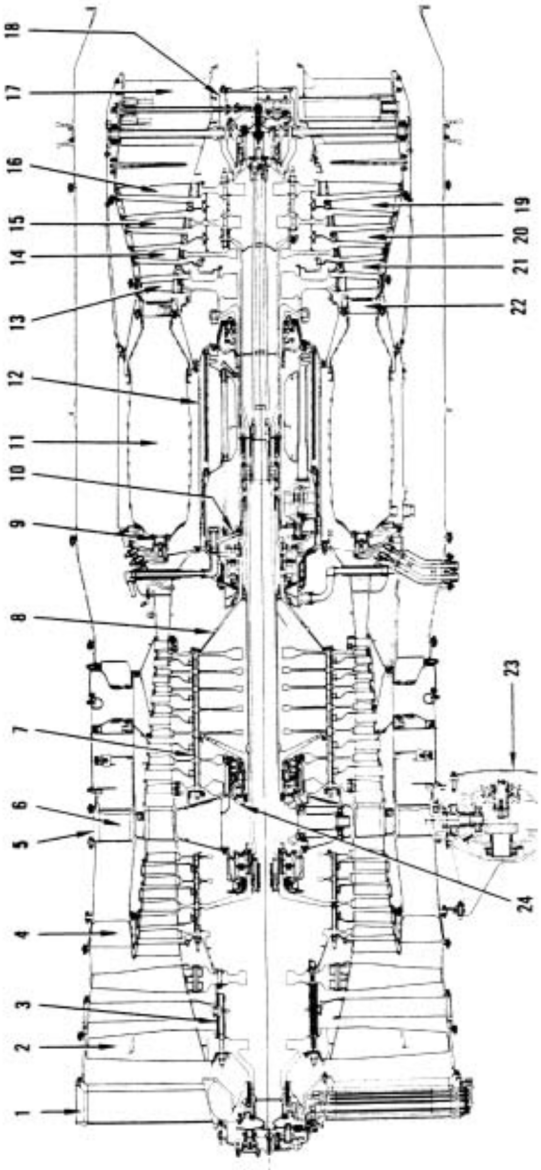
Engine Left Side View
Figure 2



Engine Right Side View (Bleed
System Prior To SB 5425)
Figure 3 (Sheet 1)



Engine Right Side View (Bleed System Incorporating SB 5425)
Figure 3 (Sheet 2)



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Cut-A-Way View
Figure 4

1. Fan Inlet Case
2. First Stage Fan Blades
3. Front Compressor Rotor
4. Fan Discharge Vanes
5. Fan Discharge Intermediate Case
6. Fan Discharge Intermediate Case Struts
7. Rear Compressor Rotor
8. Rear Compressor Rear Hub
9. Fuel Nozzle
10. No. 4 Bearing Oil Nozzle
11. Combustion Chamber
12. Combustion Chamber Inner Case
13. First Stage Turbine Blades
14. Second Stage Turbine Blades
15. Third Stage Turbine Blades
16. Fourth Stage Turbine Blades
17. Exhaust Strut
18. No. 6 Bearing Heat Shield
19. Fourth Stage Turbine Vanes
20. Third Stage Turbine Vanes
21. Second Stage Turbine Vanes
22. First Stage Turbine Vanes
23. Gearbox
24. Gearbox Drive Bevel Gear

Key to Figure 4

Pratt & Whitney
JT8D MAINTENANCE MANUAL (PN 481671)

Please insert the revised pages into this manual and delete obsoleted pages in accordance with the following List of Effective Pages. Revised pages are indicated by the letter "R", added pages by the letter "A", and deleted pages by the letter "D". Superseded pages shall be removed and destroyed.

The List of Effective Pages records not only each page of subject revision but also each previously issued page which is still current. Blank pages and pages which are no longer current do not appear on this list. If there is any question about the currency of the maintained copy, it is recommended that each page of the manual be checked off against this List of Effective Pages. Any page which does not check out with this list, either by number or by date, shall be discarded. This list is reissued in its entirety whenever this manual section is revised.

Tab Separator - How To Use

List of Effective Pages - How To Use
See end of list.

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200
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	005		APR 15/03
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	011		APR 15/03
	012		APR 15/03
	013		APR 15/03
	014		APR 15/03

TO: RECIPIENTS OF JT8D MAINTENANCE MANUAL, PART NUMBER 481671

REVISION NO. 127 DATED APRIL 15, 2004

HIGHLIGHTS - HOW TO USE

CHAPTER/ SECTION	PAGE NO	DESCRIPTION OF CHANGE	EFFECT OF CHANGE
INTRO	004	Revised name of PWAS.	-ALL

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Explanation Of Manual Format		006	

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Task 70-00-00-990-001:

1. Standard Practices - Power Plant - General

A. Effectivity

(1) JT8D-1,-1A,-1B,-7,-7A,-7B,-9,-9A,-11,-15,-15A,-17,-17A, -17R,-17AR (Douglas/Boeing DC-9, Boeing 727, Boeing 737, Super 27)

B. References

(1) Task 70-30-00-990-001, List of Materials (Consumable Materials)

C. General

WARNING: AT ONE TIME SOME ENGINE PARTS CONTAINED ASBESTOS FIBERS, AND IT IS POSSIBLE THAT SOME OF THESE PARTS CONTINUE IN SERVICE. REFER TO COMMERCIAL ENGINE SERVICE BULLETINS FOR A LIST OF PARTS THAT AT ONE TIME CONTAINED ASBESTOS. IN SOME PARTS THE MATERIAL THAT CONTAINED ASBESTOS CAN BE THE ADHESIVE. IT IS IMPORTANT TO USE CORRECT PRECAUTIONS DURING WORK WITH THESE PARTS. OPERATORS MUST OBEY ALL LOCAL REGULATIONS AND EMPLOYER POLICIES WHEN PARTS THAT CONTAIN ASBESTOS ARE TOUCHED OR DISCARDED.

WARNING: THE ASBESTOS USED IN PRATT & WHITNEY ENGINE PARTS WAS USUALLY ENCAPSULATED AND WILL NOT RELEASE DUST UNLESS THE PARTS ARE GROUND, SANDED, CUT, OR BROKEN. WHILE IT IS OUR EXPERIENCE THAT THESE OPERATIONS DO NOT USUALLY RELEASE ASBESTOS AT LEVELS MORE THAN PERMITTED EXPOSURE LIMITS, OPERATORS MUST USE ALL APPLICABLE PRECAUTIONS WHEN THEY TOUCH SUCH PARTS.

(1) Always obey the specific procedures and limits in the specific AMM maintenance tasks.

(2) Refer to the List of Materials information for all materials specified in all the Power Plant related sections of the Aircraft Maintenance Manual. Refer to Task 70-30-00-990-001.

R D. Definitions

R (1) WARNING: A WARNING tells the operator that injury or
R death is possible if the operator does not obey the
R specified instruction.

R (a) WARNING statements that are applicable to an
R instruction will precede (come before) the
R instruction and all CAUTION statements that are
R also applicable to that instruction.

R (b) WARNING statements that are applicable to an
R entire (full) procedure will follow the procedure
R title, and will come before all CAUTION or NOTE
R statements that are also applicable to the entire
R procedure.

R (2) CAUTION: A CAUTION statement tells the operator that
R damage to the part, engine, or equipment is possible if
R the operator does not obey the specified instruction.

R (a) CAUTION statements that are applicable to an
R instruction will come before the instruction and
R will follow all WARNING statements that are also
R applicable to that instruction.

R (b) CAUTION statements that are applicable to an
R entire procedure will follow the procedure
R title and all WARNING statements that are also
R applicable to the entire procedure, and will
R precede all NOTE statements that are also
R applicable to the entire procedure.

R (3) NOTE: A NOTE statement gives explanations and added
R information (data) that help the operator to do the
R specified instruction.

R (a) NOTE statements that are applicable to an
R instruction will follow the instruction.

R (b) NOTE statements that are applicable to an entire
R procedure will follow the procedure title and all

R WARNING and CAUTION statements that are applicable
R to the entire procedure.

R (c) In some procedures that are not new, it is
R possible that a NOTE statement will include
R instructions or dimensional limits (for example,
R feature controls). If a NOTE statement includes
R instructions or dimensional limits, then it is
R necessary to obey this information because it is
R necessary to complete the procedure.

Task 70-00-00-990-002:

1. Precautionary Measures To Be Taken During Removal/Installation

A. Effectivity

(1) All (727/8D, 737/8D, Super 27/8D, DC-9/8D)

B. General

(1) This task gives the general instructions for:
- The removal, inspection, and marking of engine parts.
- The installation and removal of protection covers.
- The removal of foreign materials (dropped engine parts) from the engine.
- The installation of expendable parts.
General disassembly and assembly instructions.

C. References

(1) Task 70-00-00-400-004, Application of Gasket Lubricant

(2) Task 70-00-00-400-005, Installation of Preformed Packings

(3) Task 70-00-00-400-040, Installation of Key Washers

(4) Task 70-00-00-400-041, Installation of Cotter Pins

(5) Task 70-00-00-400-043, Installation of Safety Wire

(6) Task 70-00-00-400-044, Installation of Safety Cable

D. Equipment

(1) (No specific) Tags

(2) (No specific) Caps

(3) (No specific) Magnet

(4) (No specific) Other Covers

(5) (No specific) Plugs

(6) (No specific) Torque Wrench (as specified by the specific AMM maintenance task)

E. Consumable Materials

NOTE: The P- numbers shown in this list are used by other Pratt & Whitney engine programs and are included to keep this list common with those in other engine and airframe programs.

(1) (P05-012) Double Sided Adhesive Tape

(2) (P05-255) Masking Tape

F. Procedure - General Parts Removal Instructions

(1) Always obey the specific procedures and limits in the specific AMM maintenance tasks.

WARNING: OPERATORS MUST OBEY ALL LOCAL REGULATIONS AND EMPLOYER WORK POLICIES WHEN THEY TOUCH OR DISCARD PARTS THAT CONTAIN ASBESTOS.

(2) Parts that contain asbestos

(a) At one time, some engine parts contained asbestos fibers, and it is possible that some of these parts continue in service. Refer to the commercial engine Service Bulletins for a list of parts that once contained asbestos.

(b) In some parts, the material that contains asbestos may be within an adhesive. It is important to use correct precautions during work with these parts.

(c) The asbestos used in Pratt & Whitney engine parts was usually encapsulated and will not release dust unless the parts are ground, sanded, drilled, scraped, cut, or broken. While it is our experience that these operations do not usually generate asbestos at levels greater than permitted exposure limits, operators must use all applicable precautions when they touch such parts.

(3) Put tags and marks on all parts with their engine locations at the time of removal. This will make sure of the correct subsequent installation.

(4) Examine all parts for indications of cracking, scoring, burning, or other damage at the time of removal.

(a) Put a tag on any unserviceable parts for subsequent investigation and possible repair.

(5) Do not permit dust, dirt, safety wire, safety cable, nuts, washers, or other unwanted material (foreign objects - FOD) to go into the engine. Install the applicable plugs, caps, and other covers to all openings as soon as possible during the disassembly process to prevent contamination.

CAUTION: IF YOU USE DUST CAPS FOR CONTAMINATION PROTECTION OF OPEN LINES, ALWAYS BE SURE TO INSTALL THE CAPS AROUND THE TUBE ENDS AND NOT IN THE TUBE ENDS. THERE CAN BE BLOCKAGE OF THE FLOW THROUGH THE TUBES IF THESE TUBES ARE INSTALLED ACCIDENTALLY WITH DUST CAPS IN THE TUBE ENDS.

CAUTION: DO NOT PUT TOOLS, FASTENERS, OR OTHER SMALL OBJECTS IN THE AREA BETWEEN THE INNER FAN EXIT CASE STRUTS. THESE OBJECTS CAN FALL THROUGH THE BLEED VALVE PORTS, INTO THE ENGINE, AND CAUSE DAMAGE.

(6) Foreign Objects

(a) If a part, tool, or object falls into the engine, the assembly process must stop until the fallen articles are found. Before you assemble or install any part, make sure that it is fully clean.

(b) It is possible to find and remove a fallen object with a fiber optic scope. Attach a small plastic tube (approximately 0.375 - 0.500 inch (9.50 - 12.70 mm) diameter) to the side of the fiber optic scope with (P05-255) Masking Tape at several locations. Make sure that the end of the tube is aligned with the end of the fiber optic scope and it does not decrease movement of the scope. Attach the other end of the plastic tube to a vacuum cleaner hose. Hold the object for removal by the suction of the plastic hose.

(c) If the above equipment is not available, it is possible to use a magnet to remove objects if they are magnetic. Attach the magnet to a flexible cable with (P05-255) Masking Tape so that it is possible to move it across a larger area. You can also use (P05-012) Double Sided Adhesive Tape attached to the end of a flexible cable.

(7) Do not use safety wire, lockwashers, tablocks, key washers (tab type), or cotter pins again after they are removed.
- Refer to Installation of Safety Wire (Task 70-00-00-400-043).
- Refer to Installation of Safety Cable (Task 70-00-00-400-044).
- Refer to Installation of Key Washers (Task 70-00-00-400-040).
- Refer to Installation of Cotter Pins (Task 70-00-00-400-041).

(a) Safety bushing plugs with safety wire to the assembly boss or case. Do not safety the plug to the bushing with lockwire.

(8) Discard all gaskets, packings, and rubber parts at each removal. Replace all gaskets, packings, and rubber parts with new ones at each installation. Make sure that new nonmetallic parts (such as oil seals) show no signs of deterioration from storage. Refer to Installation of Preformed Packings (Task 70-00-00-400-005).

(9) If necessary apply the applicable gasket lubricant to the gasket surfaces to prevent a bond of the gasket to the surfaces of the mating part as specified in the installation task. Refer to Application of Gasket Lubricant (Task 70-00-00-400-004).

CAUTION: BEFORE YOU USE TOOLS WITH A LAYER OF PROTECTIVE MATERIAL, MAKE SURE THAT THERE IS SUFFICIENT PROTECTIVE MATERIAL TO PREVENT DAMAGE TO ENGINE PARTS.

(10) To give protection to the critical areas of engine parts (such as compressor and turbine disks) against scratches and nicks, tool surfaces which touch these areas must have a protective material cover.

(11) If parts have a layer of corrosion preventive compounds, remove all of this compound and all other foreign material before installation.

(12) For bolts, brackets, nuts, and nut plates that are treated with molybdenum disulfide type dry film lubricants, such as (P06-038) Antigallant Compound (PWA 36545-3), it is possible that the parts may show yellowish white residue after thermal exposure. This occurs because the molybdenum disulfide lubricant in the antigallant oxidizes to a molybdenum trioxide compound. The molybdenum trioxide is not detrimental to the structural integrity or functionality of the parts. Pratt & Whitney laboratory analysis has also demonstrated that this compound is not corrosive.

R G. Storage Of Kevlar-Wrapped Fan Containment Cases

R CAUTION: IF ENGINES WITH KEVLAR-WRAPPED FAN
R CONTAINMENT CASES DO NOT HAVE COVERS TO KEEP
R OUT PRECIPITATION, THE RESULT CAN BE WATER
R ABSORBED INTO THE KEVLAR. THIS WATER IN THE
R KEVLAR WILL MAKE A KEVLAR BELT REPLACEMENT
R REPAIR NECESSARY. SUCH A REPAIR IS VERY
R EXPENSIVE AND TIME-CONSUMING.

R (1) During engine transport and during short-term storage
R outdoors before engine transport or induction into a
R shop, it is important to put the correct covers on
R engines to keep out rain, snow, sleet, or hail.

Task 70-00-00-990-003:

1. Guidelines for the Reuse of Damaged Engines and Engine Parts

A. Effectivity

(1) All (727/8D, 737/8D, Super 27/8D, DC-9/8D)

B. General

(1) This task gives the general instructions for the reuse of damaged engines and engine parts.

C. References

(1) Task 70-00-00-100-002, Cleaning Requirements After Chemical Contact With Fire Extinguishing Agents, Hydraulic Fluid, Oil, or Fuel (SPOP 425)

D. General

(1) The subsequent guidelines are provided to assist owners, operators, and maintenance facilities in the disposition of engines and engine parts involved in Abnormal Operational Circumstances.

(a) Abnormal Operational Circumstances are defined as accidents or other events which fall outside of the operating envelope for the engine, aircraft and/or the engine/aircraft combination as initially certified and where inspection, refurbishment, and repair data are not addressed by FAA-approved publications (such as, engine manuals, service bulletins).

(b) The data contained in these FAA-approved publications normally address engine and engine parts which experience wear, deterioration, or damage through exposure to the usual day-to-day operating environment.

(2) The guidelines apply to the engine-associated abnormal operational circumstances that follow:

NOTE: The guidelines refer to the abnormal operational circumstances of an engine or aircraft. It is important that the damage be identified as engine-caused or related to abnormal operation of the aircraft so correct application of the inspection guidelines can be made.

NOTE: The inspection guidelines are written for evaluation of suspected damage of an engine-induced abnormal operational circumstance (such as, a major rotor failure). These guidelines take into account the loads generated by the engine.

NOTE: These inspection guidelines, however, may not sufficiently cover engines or parts that have been subjected to excessive external loads brought on by an abnormal operation of the aircraft (such as, an aircraft landing accident where the engines are impacted). Evidence of excessive external loading generated by an aircraft abnormal operation will be found where external loads have been applied to major structural case/mounts or rotating elements that either result in the permanent distortion to the major load-carrying elements and/or the separation of a running engine from its attachments.

(a) Abnormal Operational Circumstances - Engines And Engine Parts Unacceptable For Continued Aircraft Use.

(b) Abnormal Operational Circumstances - Engines And Engine Parts Potentially Acceptable For Continued Aircraft Use.

(3) For Abnormal Operational Circumstances not addressed by these guidelines, Pratt & Whitney considers engines and engine parts unacceptable for continued aircraft use unless reviewed and approved on a case-by-case basis.

(4) The guidelines are based upon Pratt & Whitney's general experience in this area and therefore are to be used as general guidelines. In any particular incident, however, more complete information or inspection results may require alternate action. The engine or engine part owner should not rely upon the information in these guidelines without a thorough understanding of the damage to the engine or engine parts and its effect on engine operation. "It should be understood that the following are only guidelines and that any and all responsibility for returning any engine or engine part to service remains with the engine owner or part owner".

(5) The definitions that follow are for technical terms used in these guidelines:

(a) Definitions From ATA World Airlines Technical Operations Glossary (WATOG):

1 Accident: An occurrence associated with the operation of an aircraft which takes place between the time any person boards the aircraft with the intention of flight, until such time as all such persons have disembarked, in which:

a Any person suffers death or serious injury as a result of being in or upon the aircraft, or by direct contact with the aircraft or anything attached thereto; or

b The aircraft receives substantial damage; or

c Any damage is caused to the property of a third party.

2 Damage, accidental: Physical deterioration of an item caused by contact or impact with an object or influence which is not a part of the aircraft, or by incorrect manufacturing or maintenance practices.

(b) Non-WATOG Definitions Used In The Guidelines

1 Engine: Engines made by Pratt & Whitney Division of United Technologies Corporation.

2 Engine Parts: Parts sold by Pratt & Whitney and delivered as original equipment in an engine installed on an airplane or installed in a spare engine or sold by Pratt & Whitney as new spare parts for an engine.

NOTE: Engine parts include vendor-supplied accessories and components which are approved by Pratt & Whitney.

3 Abnormal Operational Circumstances: Accidents or other events which occur outside the operational envelope for the engine or the airplane or the engine and airplane combination as it was initially certified, and where inspection, refurbishment, and repair data are not in FAA-approved publications (such as, Engine Manuals, Service Bulletins, etc.).

E. Abnormal Operational Circumstances - Engines And Engine Parts Unacceptable For Continued Aircraft Use

(1) Pratt & Whitney considers engines and engine parts involved in the subsequent types of circumstances unacceptable for continued aircraft use:

NOTE: It is recognized that an aircraft could be damaged beyond economical repair without any resulting engine involvement. In such cases, the engine and engine parts can be considered "not involved" in an abnormal operational circumstance.

(a) Engines and engine parts installed in an aircraft totally destroyed by fire

(b) Engines and engine parts totally engulfed in fire to the extent that outer cases have been heat discolored and/or distorted or the engine is otherwise damaged by heat over a significant area of the engine, either external or internal

(c) Engine and engine parts installed in an aircraft totally destroyed by impact damage

(d) Evidence of excessive external loads generated by abnormal aircraft operation

(e) Engine or engine parts subjected to partial or full immersion in salt water.

F. Abnormal Operational Circumstances - Engines And Engine Parts Potentially Acceptable For Continued Aircraft Use

(1) Accidents

(a) Pratt & Whitney considers engines and engine parts involved in the types of accidents that follow potentially acceptable for continued aircraft use:

1 Type 1: Engines and engine parts involved in an accident in which the nacelles and engines remain undamaged.

2 Type 2: Engines or engine parts involved in a fire wherein a portion of the aircraft was destroyed but the engines were not subjected to fire damage.

3 Type 3: Engines which will not rotate freely but do not exhibit evidence of being subjected to excessive external loads.

4 Type 4: Engines subjected to partial or full immersion in fresh water for a brief period of time.

(b) Acceptance Criteria For Engines Or Engine Parts:

1 Engines and engine parts involved in Type 1 and Type 2 accidents can be considered "not involved" in an abnormal operational circumstance.

2 Engines and engine parts involved in Type 3 and Type 4 accidents should be 100 percent disassembled and examined. Refer to the following paragraph, Accident Engine, General Inspection Guidelines for general guidelines to be used in conjunction with FAA-approved publications.

NOTE: Owners, unable to do the necessary tests or in doubt whether to accept or reject a part, should contact Pratt & Whitney for assistance.

G. Serious Operational Events

(1) Pratt & Whitney considers engines and engine parts involved in the subsequent types of serious operational events as potentially acceptable for continued aircraft use if the criteria defined are observed.

(a) Single Fan Blade Fractures Outboard Of Part Span Shroud

NOTE: A single fan blade fracture that occurs outboard of the part span shroud can cause

varying degrees of engine damage. Refer to specific AMM maintenance and inspection tasks for bird or object ingestion inspections and damage limits. In general, the inspection guidelines that follow can be applied to events where a single blade has fractured outboard of the part span shroud.

1 Check for evidence of core ingestion.

2 Examine the fan blade shrouds for evidence of shingling.

3 Examine the fan rubstrip for damage beyond limits.

4 Check the fan exit guide vanes for damage.

5 Examine the engine externals for broken or cracked brackets and case flanges.

6 Do a borescope inspection of the compressor gaspath for excessive blade tip rub and blade-to-vane clash.

(b) Single Blade Fracture Inboard Of The Part Span Shroud Or The Multiple Fan Blade Fractures

NOTE: A single fan blade fracture inboard of the part span shroud or multiple fractures generate a significant amount of rotor vibration. More extensive inspections with disassembly of the N1 rotor modules is necessary as a minimum. Further teardown is necessary as inspection findings dictate.

1 Scrap N1 rotor mainshaft bearings and N2 rotor mainshaft roller bearings.

2 Examine the N1 rotor shaft (front compressor turbine driveshaft) for rub with the N2 rotor shaft.

3 Examine cases, bearing supports, and fan ducts for distortion and cracks particularly at engine mount locations.

4 Examine the main oil filter and chip detectors.

5 Examine the gearbox mounts.

6 Examine all external components, tubing and wiring for cracks and chafing.

7 Do a visual and borescope inspection of modules not disassembled for object damage, excessive blade tip rub, or blade-to-vane clash.

(c) Serious Engine Damage Within Modules Or Build Groups

1 Major rotating part fractures

a There is considerable variability in resultant damage from compressor and turbine blade fractures. As a minimum, the affected module requires teardown inspection. A thorough visual and borescope inspection of those modules not disassembled should be done. The modules should be disassembled if gaspath damage is noted or metal spatter is observed on hot section parts. If the blade fracture is determined to have resulted from object damage, then forward modules should be disassembled to access upstream damage and determine source of damaging object.

b Disk or spacer (rotating airseal) fractures usually result in significant damage. Moreover, the engine experiences high vibration as a result. In such events, a total engine teardown should be done. Special attention should be directed at shafts and cases for cracks and distortion.

2 Major stationary part fractures

a The most significant stationary part fractures are usually associated with compressor stators. In past experience, HPC stator fractures have caused significant resultant damage. In most instances, serious overtemperature of hot section parts has occurred. A total teardown and inspection of the affected module is necessary. Examine disks for cracks

particularly in the blade slot/rim areas. Examine blades for cracks and damage. If metal spatter or evidence of overtemperature are observed on downstream module parts, disassemble and examine downstream modules. Examine all mainshaft bearings.

(d) Mainshaft Bearing And Gearbox Distress

1 An engine which experiences a mainshaft bearing fracture must be disassembled sufficiently to examine the affected compartment area (this includes journal surfaces, compartment seals and scavenge pump). The gearbox, which includes the angle gearbox, should also be disassembled and examined since it is an integral part of the oil system where bearing debris can collect. If the affected compartment is drained through the gearbox drive (towershaft) system, disassemble and examine the drive system components.

2 For an engine which experiences shaft or bearing fracture in the gearbox drive (towershaft) system, disassemble and examine the gearbox drive system and the gearbox (this includes the angle gearbox).

3 A teardown and inspection of the gearbox and parts therein is all that is necessary if the distress is fully contained within the gearbox. However, if there is evidence of bearing, gear or spline distress, do a progressive inspection through the gearbox drive (towershaft) system until assured of no further distress.

(e) Engines Which Experience Sudden Stoppage

1 An engine experiences sudden stoppage usually as a result of significant ingestion or distress. In every instance of sudden stoppage, a total engine teardown and 100 percent engine part inspection should be done. During teardown, special attention should be paid to that which follows:

a Examine all cases and bearing supports for distortion.

b Examine rotor shafts and hubs for twist; and, splines for wear and distortion.

c Examine mainshaft bearings and replace as necessary. Sudden stoppage interrupts oil flow which may cause heat soak to damage bearings. Scrap bearings that show heat discoloration.

(f) Engines Involved In An Operational Fire (Burnthrough, Bearing Compartment, Etc.)

1 An engine involved in an operational fire should be fully torn down with subsequent inspection of all engine parts. Refer to the subsequent paragraph, Accident Engine, General Inspection Guidelines, for disposition of engine parts with particular attention to those that show heat discoloration.

2 If extinguishing agents have been applied to the engine, gaspath cleaning is to be done by the applicable AMM maintenance task, as quickly as practical, to prevent corrosion. Refer to Cleaning Requirements After Chemical Contact With Fire Extinguishing Agents, Hydraulic Fluid, Oil, or Fuel (SPOP 425) (AMM TASK 70-00-00-100-002).

H. "Impacted" And "Dropped" Engines

NOTE: Refer to the previous paragraph, Abnormal Operational Circumstances - Engines And Engine Parts Unacceptable For Continued Aircraft Use, for engines impacted and/or separated from aircraft mounts during a landing accident or incident.

(1) The damage or circumstances which can result in an "Impacted" engine include impact with the ground, a collision with a service vehicle, etc. An engine dragged on the ground or against another object is considered an impacted engine. "Dropped" engines refer to engines which are dropped entirely or on either end. Inspection requirements for impacted and dropped engines are similar and progressive in scope; that is, proceeding with further teardown is dependent on the degree of damage found at each level of inspection.

(a) For an engine mounted on an aircraft where pylon or nacelle damage has occurred, examine the engine mount flanges, cases, external components and plumbing, and gearbox housing and mounts. If the impact was such that debris may have entered the engine inlet, examine the engine for ingestion, and check the bleed system filters and valves for debris.

1 If no damage is noted, no further action is necessary.

2 If damage is noted to external components and plumbing, replace damaged items.

3 If damage is noted to mount flanges, gearbox or gearbox mounts or cases, remove the engine and examine the front and rear N1 rotor mainshaft bearings for damage or brinelling. Borescope the engine and check the rotors for freedom of movement and listen for unusual rubbing sounds.

a If damage is noted on N1 mainshaft bearings, remove and examine all mainshaft bearings.

4 Monitor chip detectors and oil filter on a more frequent basis during the initial return of the engine to service.

(b) For dropped engines do as follows:

1 Remove front and rear N1 rotor mainshaft bearings and examine for damage or brinelling.

a If bearing damage is noted, remove and examine all mainshaft bearings.

2 Do a visual and borescope inspection. Check for freedom of N1 and N2 rotor movement and listen for unusual rubbing sounds.

3 Monitor chip detectors and oil filter on a more frequent basis during initial return of the engine to service.

I. Tailpipe Fires

(1) In general, tailpipe fires of short duration and extinguished by "motoring" the engine will probably have little harmful effect on the exhaust area engine parts.

(a) Examine the exhaust area for signs of scorching. Any parts that show scorching (this includes the fan duct acoustic liners, if so equipped) should be replaced.

(2) Engines which experience a more persistent tailpipe fire or when starting overtemperature limits are exceeded during a tailpipe fire present a greater potential for thermal stress.

(a) Remove the engine and disassemble sufficiently to determine if hot section engine parts have experienced excessive temperature or if the turbine disks have been exposed to fire. The same part disposition applies as discussed in the subsequent paragraph Accident Engine, General Inspection Guidelines.

J. Accident Engine, General Inspection Guidelines

NOTE: Inspection is to be used in conjunction with existing FAA-approved data for engine parts (that is, data in publications such as Engine Manuals, Standard Practices Manuals, Component Maintenance Manuals).

(1) For the disassembly, cleaning, visual inspection, and general inspection of the engine gaspath, remove the engine and use the shop Engine Manuals, Standard Practices Manuals, Component Maintenance Manuals.

Task 70-00-00-990-004:

1. Identification of Nuts and Bolts

A. Effectivity

(1) All (727/8D, 737/8D, Super 27/8D, DC-9/8D)

B. General

(1) This task gives the general instructions for:
- The identification of nuts and bolts.
- Stainless steel bolts with reduced pitch diameters.

C. Procedure - Nut and Bolt Identification General Information

(1) Permanent material codes used on engine hardware are important for the safety of the engine. Refer to the Illustrated Parts Catalogs for part numbers and the equivalent manufacturer's numerical code identification.

D. Material Code System Used on AN, MS, And AS/Company Parts

CAUTION: USE PARTS THAT HAVE EITHER NO IDENTIFICATION OR THE MANUFACTURER'S OWN CODE IDENTIFICATION ONLY IN THE COLD SECTION OF THE ENGINE.

CAUTION: DO NOT USE PARTS WITH THE SAME MATERIAL CODE TOGETHER WITH PHYSICALLY SIMILAR PARTS THAT HAVE ANOTHER MATERIAL CODE.

CAUTION: USE ONLY NUTS AND BOLTS MADE OF SPECIAL HEAT RESISTANT ALLOYS IN THE HOT SECTION OF THE ENGINE. DO NOT USE HOT SECTION PARTS IN THE COLD SECTION OF THE ENGINE; DO NOT USE COLD SECTION PARTS IN THE HOT SECTION OF THE ENGINE.

CAUTION: DO NOT USE CADMIUM PLATED PARTS IN THE HOT SECTION OF THE ENGINE. CADMIUM PLATED PARTS MUST NOT TOUCH TITANIUM PARTS.

CAUTION: IF PARTS WITH CORRECT CODES ARE SERVICEABLE, INSTALL THEM IN THEIR ORIGINAL LOCATION DURING ASSEMBLY OF THE ENGINE OR ITS COMPONENTS. DO NOT ASSEMBLE A "C"-CODED PART IN AN "H"-CODED PART LOCATION; DO NOT

ASSEMBLE AN "H"-CODED PART IN A "C"-CODED PART LOCATION.

CAUTION: DO NOT PUT PARTS FROM ONE ENGINE TOGETHER WITH THOSE FROM ANOTHER DURING DISASSEMBLY AND CLEANING.

(1) The Letter Code (Prefix)

NOTE: The letter "E" in the material code system is used to show that a part is a standard AN, MS, or AS part with a six-digit part number. The letter "E" is not used in the material code system for parts that are made by Pratt & Whitney.

(a) "EC" or "C" = Corrosion resistant steels

(b) "EH" or "H" = Heat resistant alloys for hot section parts

(c) "ET" or "T" = Titanium alloys

(d) "E" or "S" = Common temperature range alloys

NOTE: The prefix "E" is superseded by the prefix "S" in common temperature range material codes.

(2) Number Code (Suffix)

(a) A one- or two-digit number follows the stamped or embossed letter code. Explanations of two example material codes, listed in Table 101 are as follows.

1 EC1 = Standard AN, MS, or AS engine parts made of AMS 5640 corrosion resistant steel

2 H17 = Pratt & Whitney engine parts made of AMS 5649 heat resistant material.

(3) Location of Bolt and Nut Code Identification

(a) Bolt code identification will usually be found on the top of the bolt head. See Figure 101.

(b) Nut code identification will usually be found on one side of the hex. See Figure 101.

(4) New Code Identifications

(a) These new code identifications have the prefix "B" or "P" before the material code number. This is a temporary P&W code. Later, an "S", "C", "H" or "T" number will replace the temporary number. (For example, refer to C15, H21, and T1 in Table 101.

E. Common Temperature Range, Corrosion Resistant, Heat Resistant, Titanium Or Titanium Alloy, And Special Materials

(1) For lists of Common Temperature Range, Corrosion Resistant, Heat Resistant, Titanium Or Titanium Alloy, And Special Materials Tables, refer to Table 101.

Material Code		
Standard Parts AN,MS,AS	Company Parts	Material Specification
E1	S1	AMS 6282, AMS 6320, AMS 6357, AMS 6535
E2	S2	AMS 7225
E3	S3	AMS 4121, AMS 4135, AMS 4153
E4	S4	AMS 5061
E5	S5	AMS 5045
E6	S6	AMS 6357 (Now E1/S1)
E7	S7	AMS 6280, AMS 6281, AMS 6355, AMS 6530, AMS 6550
E8	S8	AMS 6327 (Now E11/S11)
E9	S9	AMS 5024
E10	S10	AMS 5040
E11	S11	AMS 6322, AMS 6323, AMS 6325, AMS 6327, AMS 6358
E12	S12	AMS 4037, AMS 4120, AMS 4152
E13	S13	AMS 4045, AMS 4122, AMS 4139, AMS 4154
E14	S14	AMS 4152 (Now E12/S12)
E15	S15	AMS 4153 (Now E3/S3)
E16	S16	AMS 4154 (Now E13/S13)
E17	S17	AMS 5060
E18	S18	AMS 5062
E19	S19	AMS 5120
E20	S20	AMS 5121
E21	S21	AMS 6324
E22	S22	AMS 6328
E23	S23	AMS 6350, AMS 6370, AMS 6371
E24	S24	AMS 6352 (Non-current), AMS 6365, AMS 6372

Material Code		
Standard Parts AN,MS,AS	Company Parts	Material Specification
(CONTINUED)		
E25	S25	---
E26	S26	AMS 6355 (Now E7/S7)
E27	S27	AMS 6358 (Now E11/S11)
E28	S28	AMS 6323 and AMS 6371 (Now E23/S23)
E29	S29	---
E30	S30	AMS 6381, AMS 6382
E31	S31	AMS 6412, AMS 6413
E32	S32	AMS 6440, AMS 6441
E33	S33	AMS 4500
E34	S34	AMS 6359, AMS 6415
E35	S35	---
E36	S36	AMS 6300 (Non-current)
E37	S37	AMS 6304, (Was PWA 722, P5), AMS 7454, AMS 7455, AMS 7458
E38	S38	AMS 6418
E39	S39	AMS 6485
E40	S40	AMS 4003
E41	S41	AMS 4150
E42	S42	AMS 4352
		Corrosion Resistant Material
EC1	C1	AMS 5640
EC2	C2	AMS 5628
EC3	C3	AMS 5515, AMS 5516, AMS 5517, AMS 5518, AMS 5519, AMS 5636 (Was EC5/C5), AMS 5637, AMS 7472
EC4	C4	AMS 7228
EC5	C5	AMS 5636 (Now EC3/C3)
EC6	C6	AMS 5354, AMS 5508, AMS 5616, AMS 7470
EC7	C7	AMS 5610
EC8	C8	AMS 5504 (Was EC11/C11), AMS 5612, AMS 5613
EC9	C9	AMS 5624
EC10	C10	AMS 5513, AMS 5560, AMS 5565, AMS 5566, AMS 5639
EC11	C11	AMS 5504 (Now EC8/C8)
EC12	C12	AMS 5738
EC13	C13	AMS 5630
EC14	C14	AMS 5643
EC15	C15	AMS 5625 (Was P10)
EC16	C16	AMS 5506, AMS 5620 (Was P3), AMS 5621
EC17	C17	AMS 5644 (Inactive for New Design)

Material Code

Standard Parts AN,MS,AS	Company Parts	Material Specification
(CONTINUED)		
EC18	C18	AMS 5743 Heat Resistant Materials
EH1	H1	AMS 7229
EH2	H2	AMS 7232
EH3	H3	AMS 5526; AMS 5527, AMS 5721, and AMS 7476 (All 3 Inactive for New Design)
EH4	H4	AMS 5642
EH5	H5	AMS 5512, AMS 5571, AMS 5646
EH6	H6	AMS 5733 (Inactive for New Design) (Was PWA 746)
EH7	H7	AMS 5510, AMS 5557, AMS 5559, AMS 5570, AMS 5576, AMS 5645
EH8	H8	AMS 5524, AMS 5648
EH9	H9	AMS 5540, AMS 5580, AMS 5665
EH10	H10	AMS 5667 (Now EH14/H14)
EH11	H11	AMS 5521, AMS 5572, AMS 5651
EH12	H12	AMS 5522 (Inactive for New Design), AMS 5652
EH13	H13	(Now EH3/H3)
EH14	H14	AMS 5542, AMS 5667 (Was EH10/H10), AMS 5668
EH15	H15	CHROMEL
EH16	H16	ALUMEL
EH17	H17	AMS 5649
EH18	H18	AMS 5532, AMS 5768
EH19*	H19*	AMS 5525, AMS 5731, AMS 5732, AMS 5734, AMS 5736, AMS 5737, AMS 7481
EH20	H20	AMS 5511, AMS 5647
EH21	H21	AMS 5754 (Was P19)
EH22	H22	AMS 5530; AMS 5750 (Inactive for New Design)
EH23	H23	AMS 5545, AMS 5712, AMS 5713, AMS 7469
EH24	H24	AMS 5551, AMS 5756, and AMS 5757 (All 3 Inactive for New Design)
EH25	H25	AMS 5660, PWA 1003 (Was PWA 1002, P11)
EH26	H26	AMS 5706, AMS 5708 (Was PWA 90), AMS 5709 (Was P15), AMS 7471, PWA 686, PWA 687 (Was CF236, P18), AMS 5707 (Was PWA 1004)
EH27	H27	AMS 5759
EH28	H28	AMS 5662, PWA 1009
EH29	H29	AMS 5666 (Was P28)

*or Knurl (A knurl on the washer face diameter is sometimes used on double hex castellated nuts for

Material Code

Standard Parts AN,MS,AS	Company Parts	Material Specification

(CONTINUED)

material identification instead of the code.)

Heat Resistant Titanium Or Titanium Alloy Materials

ET1	T1	AMS 4921 (Was P8)
ET2	T2	AMS 4923
ET3	T3	AMS 4925
ET4	T4	AMS 4927
ET5	T5	AMS 4928 (Was PWA 682, P12), AMS 4967, AMS 7461
ET6	T6	AMS 4929

Special Materials

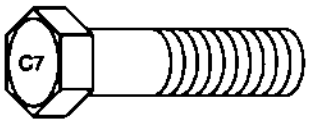
B7	ASTM A 193 Grade B7
B16	ASTM A 193 Grade B16
B660	ASTM A 453 Grade B660
P3	AMS 5620 (Now EC16/C16)
P5	PWA 722 (Now AMS 6304, E37/S37)
P8	AMS 4921 (Now ET1/T1)
P9	AMS 6302 (Inactive)
P10	AMS 5625 (Now EC15/C15)
P11	PWA 1002 (Now PWA 1003, EH25/H25)
P12	PWA 682 (Now AMS 4928, ET5/T5)
P15	AMS 5709 (Now EH26/H26)
P18	CF236 (Now EH26/H26)
P19	AMS 5754 (Now EH21/H21)
P20	PWA 1202
P21	PWA 1010
P23	AMS 7477
P24	AMS 7461
P25	PWA 91
P26	PWA 1006*, PWA 1008*, PWA 1013
P27	AMS 7236
P28	AMS 5666 (Now EH29/H29)
P29	PWA 92, AMS 5828
P30	AMS 5758

*Canceled Specification

Table 101 Material Codes - Common Temperature Range Materials

F. Stainless Steel Bolts With Reduced Pitch Diameters

(1) At engine manufacture, it is customary to provide bolts with reduced pitch diameter for use in hot sections of engines. This will minimize possibility of bolt and nut seizure. This is standard practice for locations where parts are subjected to temperatures in excess of 500° F (260° C).



TYPICAL BOLT CODE IDENTIFICATION LOCATION

TYPICAL NUT CODE IDENTIFICATION LOCATION

G-00511 (0802)
PW V

Bolt and Nut Code Identification
Figure 101
(Task 70-00-00-990-004)

Task 70-00-00-990-005:

1. Check for Reuse of Self-Locking Fasteners

A. Effectivity

(1) All (727/8D, 737/8D, Super 27/8D, DC-9/8D)

B. General

(1) This task gives the general instructions for checking self-locking fasteners for reuse.

C. References

(1) Task 70-00-00-990-004, Hardware Material Identification

D. Equipment

(1) (No specific) Torque Wrench (as specified by the specific AMM maintenance task)

E. Procedure - General

(1) Always obey the specific procedures and limits in the specific AMM maintenance tasks.

(2) To identify the hardware material (composition), refer to Hardware Material Identification (Task 70-00-00-990-004).

(3) Self-locking fasteners are designed for a limited number of reuses to keep the quality of their self-locking function.

(4) Discard the fastener if the self-locking function is not correct.

(5) Do not try to repair a fastener in this condition.

F. Torque Limit

(1) Before you use a self-locking fastener again, test the self-locking function of fasteners by one or more of the methods which follow.

(a) Use a torque wrench to test each part and compare to the values specified in Table 101.

(b) Use feel to test each part during the final assembly by the assembly mechanic.

NOTE: If the above method is used, the assembly mechanic must get training in the usual or new part feel of the applicable fasteners. If the mechanic finds excessive torque looseness or torque drag during the installation of a fastener, replace the fastener with one which is acceptable as specified in Table 101.

(c) Discard the fastener and replace with a new part.

(2) Use Table 101 for prevailing torque-type locknuts or helical coil inserts, and self-locking bolts or screws.

(a) Test the torque with the self-locking feature fully engaged and the fastener unseated so that only the frictional hold on the screw thread is measured for the breakaway and locking (drag) torques.

(b) Minimum Breakaway Torque

1 This is the minimum torque necessary to initially turn an installed nut on a bolt, or a bolt in a self-locking nut or helical coil insert.

2 The minimum breakaway torque must not be less than the value given.

(c) Maximum Locking Torque

1 This is the torque necessary to continuously turn a loosened nut on a bolt, or a bolt in a self-locking nut or helical coil insert.

2 The maximum locking torque must not be more than the given value.

Thread Size	Minimum Breakaway Torque lbf-in (N.m)	Maximum Locking (Drag) Torque lbf-in (N.m)
0.112 - 40	0.5 lbf-in (0.056 N.m)	3.0 lbf-in (0.339 N.m)
0.112 - 48	0.5 lbf-in (0.056 N.m)	3.0 lbf-in (0.339 N.m)
0.138 - 32	1.0 lbf-in (0.113 N.m)	6.0 lbf-in (0.678 N.m)
0.138 - 40	1.0 lbf-in (0.113 N.m)	6.0 lbf-in (0.678 N.m)
0.164 - 32	1.5 lbf-in (0.169 N.m)	9 lbf-in (1.017 N.m)
0.164 - 36	1.5 lbf-in (0.169 N.m)	9 lbf-in (1.017 N.m)
0.190 - 24	2.0 lbf-in (0.226 N.m)	13 lbf-in (1.469 N.m)
0.190 - 32	2.0 lbf-in (0.226 N.m)	13 lbf-in (1.469 N.m)
0.250 - 20	4.5 lbf-in (0.508 N.m)	30 lbf-in (3.390 N.m)
0.250 - 28	3.5 lbf-in (0.395 N.m)	30 lbf-in (3.390 N.m)
0.3125 - 18	7.5 lbf-in (0.847 N.m)	60 lbf-in (6.779 N.m)
0.3125 - 24	6.5 lbf-in (0.734 N.m)	60 lbf-in (6.779 N.m)
0.375 - 16	12.0 lbf-in (1.356 N.m)	80 lbf-in (9.039 N.m)
0.375 - 24	9.5 lbf-in (1.073 N.m)	80 lbf-in (9.039 N.m)
0.4375 - 14	16.5 lbf-in (1.864 N.m)	100 lbf-in (11.298 N.m)
0.4375 - 20	14 lbf-in (1.582 N.m)	100 lbf-in (11.298 N.m)
0.500 - 14	24 lbf-in (2.712 N.m)	150 lbf-in (16.948 N.m)
0.500 - 20	18 lbf-in (2.034 N.m)	150 lbf-in (16.948 N.m)
0.5625 - 12	30 lbf-in (3.390 N.m)	200 lbf-in (22.597 N.m)
0.5625 - 18	24 lbf-in (2.712 N.m)	200 lbf-in (22.597 N.m)
0.625 - 11	40 lbf-in (4.519 N.m)	300 lbf-in (33.895 N.m)
0.625 - 18	32 lbf-in (3.616 N.m)	300 lbf-in (33.895 N.m)
0.750 - 10	60 lbf-in (6.779 N.m)	400 lbf-in (45.194 N.m)
0.750 - 16	50 lbf-in (5.649 N.m)	400 lbf-in (45.194 N.m)
0.875 - 9	82 lbf-in (9.265 N.m)	600 lbf-in (67.791 N.m)
0.875 - 14	70 lbf-in (7.909 N.m)	600 lbf-in (67.791 N.m)
1.000 - 8	110 lbf-in (12.428 N.m)	800 lbf-in (90.388 N.m)
1.000 - 14	92 lbf-in (10.395 N.m)	800 lbf-in (90.388 N.m)

Torques For Reuse of Fasteners
Table 101

Task 70-00-00-990-006:

1. Marking Parts (Temporary and Permanent)

A. Effectivity

(1) All (727/8D, 737/8D, Super 27/8D, DC-9/8D)

B. General

(1) This task gives the general instructions and approved materials for the marking of engine parts.

C. Consumable Materials

NOTE: The P- numbers shown in this list are used by other Pratt & Whitney programs and are included to keep this list common with other engine and airframe programs.

(1) (P05-018) Pencil (PMC 4059)

(2) (P05-022) Dye - Layout and Identification, LOX Compatible (Purple) (PMC 4062)

(3) (P05-026) Black Metal Marking Ink (PMC 4057-1)

(4) (P05-040) Varnish - Phenolic Resin, Corrosion-Preventive (AMS 3132)

(5) (P05-049) White Metal Marking Ink (PMC 4057-2)

(6) (P05-232) Metal Marking Crayon (Soft) (PMC 4058)

(7) (P05-366) Dye, Layout and Identification (PMC 4039)

(8) (P05-408) White Marker (Felt Tip) (SPMC 198-1)

(9) (P05-409) Black Marker (Metal Tip) (SPMC 198-2)

(10) (P05-410) Yellow Marker (Felt Tip) (SPMC 198-3)

(11) (P05-411) Black Stamping Ink (PMC 4021)

(12) (P05-413) Black Marking Ink (PMC 4500)

(13) (P05-414) Black Marker (Extra Fine Point) (PMC 4557)

(14) (P05-415) Black, Trace Element Certified (TEC) Marking Pen (PMC 4556)

(15) (P05-416) White Chalk (Low Dust) (PMC 4552)

(16) (P05-417) Marking Pen (White or Yellow Paint) (PMC 4554)

(17) (P05-418) Dye, Layout and Identification (Blue) (PMC 4504)

(18) (P05-419) Dye, Layout and Identification (Red) (PMC 4503)

(19) (P05-423) Felt Tip Marker (PMC 4050)

(20) (P05-441) White Metal Marking Ink (PMC 4057-10)

(21) (P05-465) Green Metal Marking Ink (PMC 4057-5)

(22) (P05-470) High Purity Marker (Blue) (PMC 4563-1)

(23) (P05-471) High Temperature Marker (Blue) (PMC 4563-2)

(24) (P05-472) High Purity, Black, Trace Element Certified Marker (PMC 4564).

(25) (P05-477) High Temperature Marker (Blue) (PMC 4563-3)

(26) (P07-001) Lacquer (PMC 1641)

D. Procedure - General

CAUTION: THE MARK MUST NOT CHANGE THE CONDITION OR THE OPERATION OF THE PART. ONLY THE APPLICABLE PRATT & WHITNEY PROCEDURE IS TO BE USED TO MAKE MARKS.

(1) Always obey the specific procedures and limits in the specific AMM maintenance tasks.

(2) Marks made on engine parts and assemblies must be easily read and must not be easily removed.

(a) It must be easy to read characters accurately with no aid to the eye.

(b) Where there are unusual area or surface limits, a maximum of 3.5X magnification is permitted to get the necessary readability.

(c) The location of a mark must be as specified in the Service Bulletin or AMM maintenance task.

NOTE: Be sure to apply the mark only on a surface that will not move relative to a surface that touches it after you assemble the parts.

(3) Except where specified differently, reidentification of parts, reapplication and/or relocation of marks on a part must be done adjacent to, or in a location almost the same as that of the initial marking. Where reidentification or corrective marks are specified, removal of all or part of the old marking can be necessary. In these cases, use an approved marking method to draw a wavy line, loop, flat oval, or X's through the character(s) or symbol(s) to be removed.

(4) All the characters in a mark, unless specified differently, must be 0.060 - 0.160 inch (1.5 - 4.1 mm) high. In special cases, when the mark is a function of the size or configuration of the part, characters not less than 0.016 inch (0.406 mm) nor more than 0.500 inch (12.700 mm) in height are permitted.

(5) If the surface specified for a mark will get a surface treatment coating (for example, paint), you must apply the mark before you apply the coating. Use an approved permanent marking method that will show through the final surface treatment.

(a) If none of the specified marking methods will show through the coating, then it is permitted to use the applicable step to make the mark after you apply the coating:

1 On external surfaces, apply the mark with ink and a stamp, and then apply a full layer of (P07-001) Lacquer (PMC 1641) on the mark.

2 On internal surfaces, apply the mark by the applicable step:

a If permitted by the repair instructions, apply the mark by the vibration peen method.

b Apply the mark with ink and a stamp, and then apply a full layer of transparent (P05-040) Varnish (AMS 3132) on the mark.

(6) In electric arc scribing (for example, hand arc scribing), the characters are made by the action of an electric arc between a surface and an electrode (scriber). Electric arc scribing is not a satisfactory marking method to use for jet engine parts and must not be used.

(7) In acid etching, the characters are made by the action of an acid on the surface of the part. Acid etching is not recommended because it can possibly cause corrosion.

(8) Soapstone must not be used to make a mark on engine parts.

(9) Wherever the vibration peen method is approved, identify offset holes in mating parts with a vibration peened "X" mark adjacent to the offset hole as long as the condition or operation of the part is not changed.

E. Permanent Marking Methods

(1) General

(a) Permanent methods of marking are those in which marking is legible during the normal service life of the part.

(b) Permanent markings must not extend onto any radius, chamfer, sharp edge, bead, or fillet adjacent to the specified marking surface.

(2) Applied Marking Methods

(a) Metal Stamping

1 Characters are produced by forcible displacement of material.

a Hammer - characters are made one at a time or in groups by a force applied mechanically or manually.

b Press - characters are produced individually or in groups by a force applied as you steadily increase the controlled pressure.

c Roll - characters are made as the part or the tool or both the part and the tool turn when they touch each other under a controlled force.

2 Stamps used for marking must make fillets and radii at all intersecting surfaces of the characters.

3 Parts marked by this method must have the marking area sufficiently back-supported to prevent dangerous stresses.

4 This method is not permitted if the hardness of the part at the time of marking is higher than Rockwell C45 or equivalent.

5 If the metal is raised more than 0.001 inch (0.025 mm) by this method of marking, it is necessary to carefully remove it.

NOTE: It is necessary to remove all raised metal around the characters on the surfaces of bearings that touch.

(b) Vibration Peen Method

1 Characters are made by vibrations from a radius-tipped, conical tool.

a Manual - tool is manually guided and has one tip.

b Mechanical - tool is mechanically guided and has one or more tips that can make one or more full characters at the same time.

2 This method is not usually permitted if the hardness of the part at the time of marking is higher than Rockwell C45 or equivalent. It can be used on parts harder than Rockwell C45 when specifically permitted.

NOTE: The vibration peen method can be an alternative to use on those parts that had drag impression or roll marking.

(c) Engraving

1. Characters are made by a manually or mechanically guided cutter or grinder that turns.

(d) Brand

1. Characters are made by burning or displacing non-metallic material with a hot tool.

(e) Drag Impression

1. Characters are made when material is moved by force by a radius-tipped conical tool, which is drawn (dragged) across the surface of the part. This tool is mechanically guided and turns freely.

(f) Blast

1. Characters are made when an abrasive material hits the characters in the stencil area.

(3) Marking Depth

(a) The depth of the marks must be at these maximum limits, unless specified differently:

Metal Stamp, Hammer	0.010 inch (0.254 mm)
Metal Stamp, Press and Roll	0.006 inch (0.152 mm)
Vibration Peen, Manual and Mechanical	0.006 inch (0.152 mm)
Engrave, Manual and Mechanical	0.003 inch (0.076 mm)
Brand	0.010 inch (0.254 mm)
Drag Impression	0.003 inch (0.076 mm)
Blast	0.0005 inch (0.013 mm)

F. Temporary Marking Methods

(1) General

CAUTION: USE ONLY THE APPROVED MATERIALS SPECIFIED IN THE PMC'S FOR MARKING.

CAUTION: DO NOT USE LEAD AND/OR METALLIC PENCILS OR A TEMPORARY MARKING METHOD THAT CAN CAUSE DANGEROUS REMAINING CARBON, ZINC, COPPER, LEAD, OR SIMILAR MATERIAL TO OCCUR ON A PART. THIS REMAINING MATERIAL CAN CAUSE A REDUCTION IN FATIGUE STRENGTH AS A RESULT OF CARBURIZATION OR INTERGRANULAR ATTACK WHEN HEAT OF HIGH INTENSITY IS APPLIED TO THE PART. IF A MARKING MATERIAL THAT IS NOT APPROVED IS USED, REMOVE THE MARK FULLY BY SPOP 208 SOLVENT WIPE PROCEDURE. REFER TO CLEANING/PAINTING-04 (TASK 70-21-00-110-040).

(a) Temporary methods of marking are those in which the marks will correctly identify a part during the usual handling, inspection, and storage of items before final assembly and use.

(b) When you use a marking pencil, do not apply marks to the surfaces of carbon seal plates or to mating surfaces of finished machined parts. Marking material remaining on these parts could cause incorrect results during dimensional inspection and assembly.

(c) Remove these marking materials:

1 Chalk

a After inspection is completed, remove chalk from parts. Use SPOP 208 Solvent Wipe. Refer to 70-00-00, Cleaning/Painting-04 (Task 70-00-00-100-004).

2 Dye, Layout and Identification

a Remove layout and identification dye from parts before you assemble the parts in the engine. Use SPOP 208 Solvent Wipe. Refer to 70-00-00, Cleaning/Painting-04 (Task 70-00-00-100-004).

(2) Marking Methods

(a) Ink Marking

1 Characters are made by ink application that does not change the surface as mechanical methods do.

NOTE: Usually, ink stamping, when used as a temporary marking method, can be applied to a surface which, after assembly, does not move in relation to a surface that it touches (that is, a contact surface).

(3) Marking Materials

(a) This material is used to highlight stamped or vibration peened part numbers during inspection and is approved to use on all gas turbine engine alloys if you remove the material after the inspection is completed:

1 Chalk

a (P05-416) White Chalk (Low Dust) (PMC 4552).

(b) These materials are approved to use on steel, stainless steel, cobalt-base alloys, aluminum, magnesium, titanium, titanium alloys, and on nickel-base alloys other than nickel superalloys (for example, PWA 1422 or PWA 1480) unless specified differently below:

1 Crayons

a (P05-232) Metal Marking Crayon (Soft) (PMC 4058).

2 Dyes, Layout and Identification

a (P05-022) Dye - Layout and Identification, LOX Compatible (Purple) (PMC 4062)

b (P05-366) Dye, Layout and Identification (PMC 4039)

c (P05-418) Dye, Layout and Identification (Blue) (PMC 4504)

d (P05-419) Dye, Layout and Identification (Red) (PMC 4503).

3 Inks (Applied by a brush or stamp)

a (P05-026) Black Metal Marking Ink (PMC 4057-1)

NOTE: The above ink is also approved to use on aluminide coated or PWA 286 coated or ceramic coated parts and on nickel superalloys (for example, PWA 1422 and PWA 1480).

b (P05-049) White Metal Marking Ink (PMC 4057-2)

NOTE: The above ink is also approved to use on aluminide coated or PWA 286 coated parts and on nickel superalloys (for example, PWA 1422 and PWA 1480).

c (P05-411) Black Stamping Ink (For Marking on Non-porous Surfaces with a Rubber Stamp) (PMC 4021)

NOTE: The above ink is also approved to use on PWA 73, overlay, aluminide, and ceramic coated parts.

d (P05-413) Black Marking Ink (PMC 4500)

e (P05-441) White Metal Marking Ink (PMC 4057-10)

NOTE: The above ink is also approved to use on aluminide coated or PWA 286 coated parts.

f (P05-465) Green Metal Marking Ink.

NOTE: The above ink is also approved to use on nickel superalloys (for example, PWA 1422 and PWA 1480).

4 Markers

a (P05-408) White Marker (Felt Tip) (SPMC 198-1)

b (P05-409) Black Marker (Metal Tip) (SPMC 198-2)

R
R

c (P05-410) Yellow Marker (Felt Tip) (SPMC 198-3)

d (P05-414) Marker, Extra Fine Point (Black) (PMC 4557)

R CAUTION: FELT TIP MARKER (MATERIAL NO. P05-423) IS DIFFICULT TO REMOVE FROM ALUMINUM ALLOYS. THUS DO NOT USE THIS MARKER FOR TEMPORARY INSPECTION OR IN-PROCESS MARKS ON ANODIZED OR FINISHED SURFACES OF ALUMINUM ALLOY GAS TURBINE ENGINE PARTS.

e (P05-423) Felt Tip Marker (PMC 4050)

NOTE: The above marker is also approved for other applications (see Notes below). This does not always include all markers available for a given suffix.

NOTE: The Marks-A-Lot markers for PMC 4050-1 (black/chisel point) and PMC 4050-4 (black/fine point) are also approved to use on nickel superalloys and on ceramic coatings.

NOTE: The Sharpie markers for PMC 4050-4 (black/fine point) and all markers for PMC 4050-17 (black/bold fine point), PMC 4050-7 (red/fine point), PMC 4050-12 (red/extra fine point), PMC 4050-15 (red/ultra fine point), and PMC 4050-18 (red/bold fine point) are also approved to use on ceramic and overlay and aluminide coatings.

NOTE: All PMC 4050-6 (blue/fine point) and all PMC 4050-16 (blue/ultra fine point) markers are approved to use on aluminide coatings.

R NOTE: Felt tip marker (Material No. P05-423) is not approved to use on Alloy C titanium alloy.

f (P05-470) Marker, High Purity (Blue) (PMC 4563-1)

g (P05-471) Marker, High Temperature (Blue) (PMC 4563-2)

h (P05-472) Marker - High Purity, Black, Trace Element Certified (PMC 4564)

i (P05-477) Marker, High Temperature (Blue) (PMC 4563-3).

5 Pencils

a (P05-018) Metal Marking Pencil (Hard) (PMC 4059).

6 Pens

a (P05-415) Black, Trace Element Certified (TEC) Marking Pen (PMC 4556)

b (P05-417) Marking Pen (White or Yellow Paint) (PMC 4554).

R
R

Task 70-00-00-990-007-A:

R 1. Removal of Broken Bolts Or Studs And Installation Of Oversize
R Studs (SPOP 416)

A. Effectivity

(1) ALL (727/8D, 737/8D, Super 27/8D, DC-9/8D)

B. General

R (1) This task gives the general instructions and equipment
R necessary for the removal of broken bolts or studs and
R the installation of oversize studs.

C. Consumable Materials - None

D. Equipment

(1) (No specific) Bolt/Stud Extraction Tool (Commercially available)

R E. Procedure To Remove Broken Bolts Or Studs

(1) Always obey the specific procedures and limits in the specific AMM maintenance tasks.

(2) Remove broken bolts and/or studs by mechanical removal methods, unless specified differently by the AMM maintenance task.

(3) Drill a hole into the end of the broken bolt and/or stud. Refer to the tool manufacturer's instructions for the correct size drill.

(4) Put the extraction tool into the drilled hole and lock into position.

(5) Turn the extraction tool in a counterclockwise direction to remove the broken bolt.

(6) Tap the threads if necessary to clean or chase the threads.

R (7) Examine the threads for damage or an oversize
R condition. If there is thread damage or an oversize
R condition, do the subsequent Procedure for the
R Installation of Oversize Studs.

R F. Procedure for the Installation of Oversize Studs

R (1) General

R (a) Replace studs that are stretched, loose, or have
R thread damage with oversize studs.

R (b) It is permitted to replace an oversize stud to the
R next oversize one time. If more than the second
R oversize replacement is necessary, get approval
R from:

R Manager Of Customer Technical Service (CTS)
R 400 Main Street - Mail Stop 163-20
R East Hartford, CT 06108 USA
R Fax: 1-860-565-9825

R (c) Where the threads of a stud hole became damaged or
R stripped, it is possible, if there is sufficient
R material around the hole, to drill and tap the
R hole again for a special stepped stud. See Figure
R 101.

R (d) When you install a stud that has a cotterpin or
R safety wire hole, measure the projection length
R from the bottom of the stud hole.

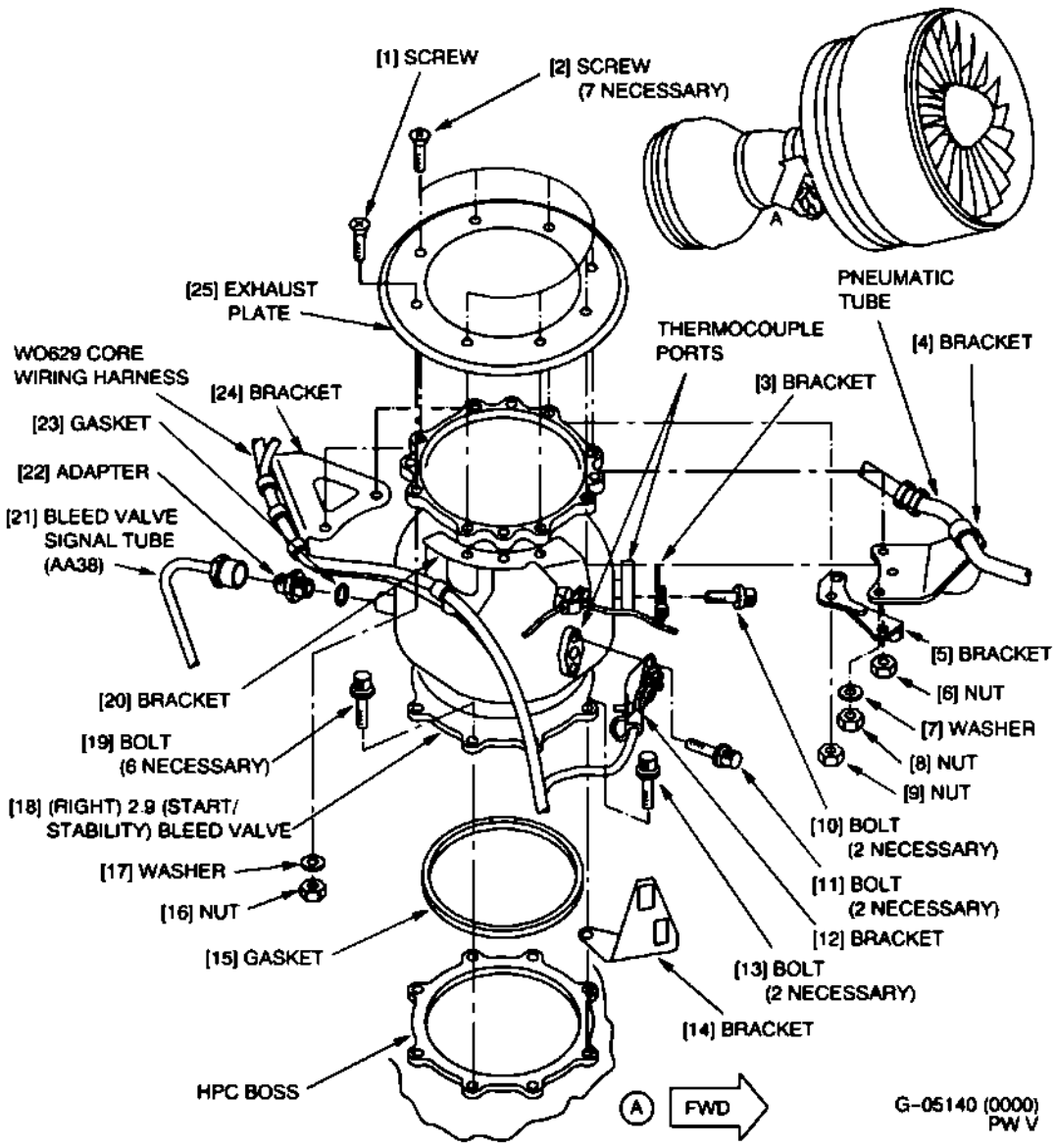
R (e) See the specific repair chart applicable to the
R studs to be replaced.

R (2) Stud Torques

R (a) For standard torques, refer to Standard Torques in
R Removal/Installation-32 (Task 70-00-00-400-032).

R (3) Stud Lubrication

R (a) For information on oil lubricated studs,
R antigallant lubricated studs, and studs in
R self-locking helical coil inserts, refer to
R Standard Torques in Removal/Installation-32 (Task
R 70-00-00-400-032).



Replacement Stud Types
Figure 101
(Task 70-00-00-990-007-A)

Task 70-00-00-400-001:

1. Application of Penetrating Oils (SPOP 427)

A. Effectivity

(1) All (727/8D, 737/8D, Super 27/8D, DC-9/8D)

B. General

(1) This task gives the general instructions for the application of approved penetrating oils on engine parts.

C. References

(1) Task 70-00-00-100-004, Degrease Parts by Solvent Wipe (SPOP 208)

D. Consumable Materials

NOTE: The P- numbers shown in this list are used by other Pratt & Whitney engine programs and are included to keep this list common with other engine and airframe programs.

(1) (P03-007) Penetrating Oil (PMC 9534)

(2) (P03-015) Penetrating Fluid (PMC 9545)

(3) (P03-016) Penetrating Fluid (PMC 9503)

(4) (P03-017) Penetrating Oil (SPMC 188)

E. Procedure - Instructions

(1) Always obey the specific procedures and limits in the specific AMM maintenance tasks.

(2) Use penetrating oils or fluids to make the disassembly of parts easier.

(3) Apply one of the materials which follows.

(a) (P03-007) Penetrating Oil (PMC 9534)

(b) (P03-015) Penetrating Fluid (PMC 9545)

(c) (P03-016) Penetrating Fluid (PMC 9503)

(d) (P03-017) Penetrating Oil (SPMC 188).

(4) After the disassembly, clean the remaining penetrating oil or fluid. Refer to Degrease the Parts by Solvent Wipe (SPOP 208) (Task 70-00-00-100-004).

Task 70-00-00-400-002:

1. Application Of Antigalling And Anti-Seize Compounds

A. Effectivity

(1) All (727/8D, 737/8D, Super 27/8D, DC-9/8D)

B. General

(1) This task gives the general instructions for the application of approved antigalling and anti-seize compounds.

C. References

(1) Task 70-00-00-400-100, Standard Torques

(2) Task 70-00-00-050-001, Application of Penetrating Oils (SPOP 427)

D. Consumable Materials

NOTE: The P- numbers shown in this list are used by other Pratt & Whitney engine programs and are included to keep this list common with those in other engine and airframe programs.

R (1) (P03-002) Lubricating Oil (MIL-L-6081) (PMC 9852)

R (2) (P06-009) Anti-Seize Compound (PMC 9523)

R (3) (P06-017) Anti-Seize Lubricant (PWA 541)

R (4) (P06-038) Antigallant Compound (PWA 36545-3)

R E. Procedure - General Information

R CAUTION: IT IS VERY IMPORTANT TO APPLY ANTIGALLING
R AND ANTI-SEIZE COMPOUNDS IN A SMOOTH, THIN
R LAYER AND TO FULLY REMOVE ALL MATERIAL THAT
R IS NOT NECESSARY. THIS REMOVAL PREVENTS
R CONTAMINATION IN OR ON PARTS, PASSAGES,
R OR SURFACES WHERE THE MATERIAL CAN CAUSE
R MALFUNCTION OR EVEN FAILURE OF THE ENGINE.

R (1) Always obey the specific procedures and limits in the
R specific AMM maintenance tasks.

R (2) Use antigalling and anti-seize compounds only when they
R are specified in assembly instructions.

R (3) When necessary, you can apply anti-seize compounds at
R assembly as an aid in the disassembly of some hot
R section and free turbine threaded fittings. Apply
R such compounds only when specified by assembly or
R maintenance instructions.

R (4) Use SPOP 427 penetrating oil at disassembly as an aid
R in the removal of screws, nuts, and bolts. Refer to
R Application of Penetrating Oils (SPOP 427) (AMM TASK
R 70-00-00-400-001).

R NOTE: Penetrating oil prevents damage (for example,
R breaking or stripping) of the fastening
R hardware.

R (5) Do not apply oil if you applied an antigalling or
R anti-seize compound during a repair or an assembly
R procedure.

F. Procedure - Materials

(1) Always obey the specific procedures and limits in the specific AMM maintenance tasks.

R (2) (P06-017) Anti-Seize Lubricant (PWA 541), a mixture
R of molybdenum disulfide powder and grade 1010 oil,
R is satisfactory to use in some assembly procedures
R when specified. The make-up of (P06-017) Anti-Seize
R Lubricant (PWA 541) follows:

R (a) Fully mix the Anti-Seize Compound (molybdenum
R disulfide powder) and Lubricating Oil (grade 1010)
R in these proportions:

R 1 (P06-009) Anti-Seize Compound (PMC 9523):
R 80%±3% by weight

R 2 (P03-002) Lubricating Oil (PMC 9852): 20%±3%
R by weight.

R (b) Continue to mix until the lubricant is smooth and
R without lumps, cakes, skins, and grit.

R (c) Keep the lubricant in closed containers to prevent
R contamination.

R (3) Heat can cause a yellow-white color to show on bolts, brackets, nuts, and nutplates that have a layer of molybdenum disulfide-type dry film lubricants on them.

R NOTE: (P06-038) Antigallant Compound (PWA 36545-3) is an example of a molybdenum disulfide-type dry film lubricant.

R (a) This yellow-white color occurs because the molybdenum disulfide lubricant in the antigalling compound oxidizes to a molybdenum trioxide compound.

R (b) This oxidation can start as low as 750°F (399°C) but increases quickly at temperatures higher than 900°F (482°C).

R (c) The molybdenum trioxide compound is not harmful to the structure or function of the parts.

R (d) Pratt & Whitney laboratory analysis tests show that this compound does not cause corrosion.

R G. Torque Requirements

R (1) The torque values, shown in Standard Torques (AMM TASK 70-00-00-400-032), include limits for parts lubricated with anti-seize compounds.

Task 70-00-00-400-003:

1. Application of Sealing Compounds

A. Effectivity

(1) All (727/8D, 737/8D, Super 27/8D, DC-9/8D)

B. General

(1) This task gives the general instructions for the application for approved sealing compounds.

C. References

(1) Task 70-00-00-100-004, Degrease Parts by Solvent Wipe (SPOP 208)

D. Consumable Materials

NOTE: The P- numbers shown in this list are used by other Pratt & Whitney engine programs and are included to keep this list common with those in other engine and airframe programs.

(1) (P04-005) Extreme Heat Grease (PMC 9630)

(2) (P06-014) Gasket Lubricant (PMC 9652)

(3) (P09-003) Silicone Rubber Sealant (PMC 9926)

(4) (P09-005) Sealing Compound (PWA 36000-3)

(5) (P09-006) Sealing Compound (PWA 36000-4)

(6) (P09-007) Sealing Compound (PMC 9925)

(7) (P09-008) Sealing Compound (PMC 9931)(PWA 36002)

(8) (P09-009) Sealing Compound (PMC 9929)

E. Procedure - General Instructions

(1) Always obey the specific procedures and limits in the specific AMM maintenance tasks.

CAUTION: DO NOT USE SEALING COMPOUNDS AS AN ALTERNATIVE TO CORRECTLY FINISHED PARTS, GOOD ASSEMBLY PROCEDURES, OR ACCURATE DIMENSIONS.

(2) Sealing compounds are available to be used on threaded, metal-to-metal, and mating surfaces with gaskets.

(3) Clean all unwanted materials such as oil, grease or gasket material from mating surfaces before applying sealant compound. Refer to Degrease Parts by Solvent Wipe (SPOP 208) (Task 70-00-00-100-004).

(4) Apply a thin layer of sealing compound to both mating surfaces.

(5) Always remove unwanted sealing compound to prevent subsequent damage to the engine.

F. Material Usage

(1) (P09-005) Sealing Compound (PWA 36000-3) is for use on threaded fittings.

(2) (P09-006) Sealing Compound (PWA 36000-4) is for use on metal-to-metal mating surfaces.

CAUTION: DO NOT USE (P09-003) SILICONE RUBBER SEALANT NEAR SILICONE RUBBER OR ELECTRICAL CONNECTORS.

(3) (P09-003) Silicone Rubber Sealant (PMC 9926) is for use on threaded fittings and metal-to-metal surfaces.

NOTE: You can use (P09-003) Silicone Rubber Sealant (PMC 9926) on gasket surfaces to keep the bond with mating surfaces to a minimum or to prevent small amount of leakage.

(4) (P09-007) Sealing Compound (PMC 9925) and sealing compound (P09-009) are for use on threaded fittings and metal-to-metal mating surfaces.

(5) (P09-008) Sealing Compound (PMC 9931)(PWA 36002) is for use on threaded permanent plugs and inserts.

(6) (P06-014) Gasket Lubricant (PMC 9652) and (P04-005) Extreme Heat Grease (PMC 9630) are for use on gasket surfaces to keep bonds to a minimum, or to prevent small amounts of leakage.

G. Compound Usage Limit

(1) Unless specified, do not use sealing compounds at the locations which follow:

(a) All connections in the engine fuel system

(b) All splined assemblies

(c) All metallic oil seal rings and oil ring carrier grooves

(d) Any parts which move in relation to another part during engine operation.

Task 70-00-00-400-004:

1. Application of Gasket Lubricant

A. Effectivity

(1) All (727/8D, 737/8D, Super 27/8D, DC-9/8D)

B. General

(1) This task gives the general instructions for the application for approved gasket lubricants.

C. References

(1) Task 70-00-00-100-004, Degrease Parts by Solvent Wipe (SPOP 208)

D. Consumable Materials

NOTE: The P- numbers shown in this list are used by other Pratt & Whtiney engine programs and are included to keep this list common with those in other engine and airframe programs.

(1) (P06-014) Gasket Lubricant (PMC 9652)

E. Procedure - General Instructions

(1) Always obey the specific procedures and limits in the specific AMM maintenance tasks.

(2) Degrease the mating surfaces. Refer to Degrease Parts by Solvent Wipe (SPOP 208) (Task 70-00-00-100-004).

(3) Apply a thin layer of the (P06-014) Gasket Lubricant (PMC 9652) to the surface of the gasket.

Task 70-00-00-400-005:

1. Installation of Preformed Packings

A. Effectivity

(1) All (727/8D, 737/8D, Super 27/8D, DC-9/8D)

B. General

(1) This task gives the general instructions for the lubrication and installation of preformed packings.

C. Consumable Materials

NOTE: The P- numbers shown in this list are used by other Pratt & Whitney engine programs and are included to keep this list common with those in other engine and airframe programs.

(1) (P03-001) Engine Oil (PWA 521)

(2) (P06-002) White Petrolatum (PMC 9609)

(3) (P06-053) Seal Ring Lubricant (PWA 36500)

D. Procedure - Necessary Lubricant Instructions

NOTE: Preformed rubber o-ring packings are referred to as packings.

(1) Always obey the specific procedures and limits in the specific AMM maintenance tasks.

CAUTION: APPLY A THIN FILM OF LUBRICANT ON PACKINGS BEFORE INSTALLATION. CORRECT LUBRICATION AND ASSEMBLY WILL HELP PREVENT DAMAGE TO THE PACKING THAT CAN CAUSE ENGINE DAMAGE OR A SHUTDOWN.

CAUTION: DO NOT APPLY PETROLATUM TO PACKINGS USED IN FUEL OR OIL SYSTEMS. PETROLATUM DOES NOT DISSOLVE EASILY IN FUEL OR OIL AND CAN CAUSE BLOCKAGES IN SMALL PASSAGES AND CLOGGED FILTERS. CORRECT LUBRICATION AND ASSEMBLY WILL PREVENT DAMAGE TO THE PACKING THAT CAN CAUSE ENGINE DAMAGE OR A SHUTDOWN.

(2) Apply the correct lubricant to each packing before engine assembly as follows.

(a) Find the material specification of the packing. This is often shown on the package.

(b) Determine the type of system (fuel, oil, or air) where the packing will be installed.

(c) Refer to Table 401 and select the necessary lubricant. Use only the lubricant specified for the packing material.

(d) Apply the necessary lubricant to each packing.

Engine System	Packing Material	Material Specification	Lubrication Specification
Fuel	Fluoro-silicone	AMS 7273	(P03-001) Engine Oil or (P06-053) Lubricant
Oil or Fuel	Fluoro-carbon	AMS 7276, AMS 7278, AMS 7280	(P03-001) Engine Oil or (P06-053) Lubricant
Air, or Water	Silicone	AMS 3301, AMS 3302, AMS 3303, AMS 3304, AMS 3305, AMS 3315, AMS 3320, AMS 3332, AMS 3334, AMS 3335, AMS 3336, AMS 3338, AMS 3345, AMS 3346, AMS 3356, AMS 3357, AMS 7267	(P06-002) White Petrolatum See NOTE 1.

NOTE 1:
Use only a small amount of (P06-002) White Petrolatum (PMC 9609) on Silicone packings used in air systems. Hot air can move this lubricant into downstream components and cause contamination. Never use (P03-001) Engine Oil (PWA 521) on Silicone packings.

Packing Lubricant
Table 401

E. Instructions for the Installation of Preformed Packings

(1) Always use new packings at each assembly.

(2) Check the package for a date. This date is called the shelf life.

(3) Do not use packings that have gone past the shelf life date.

R (4) If there is no date on the package, there is no shelf
R life limit.

R (5) Apply a layer of the specified lubricant to the packing
R before assembly.

R NOTE: Use only the lubricants specified for the
R preformed packing material, and be sure that the
R packing has the lubricant fully on it.

R (6) Do a visual inspection of the packing mating surfaces
R and all other surfaces that the packing will touch
R during installation. Be sure that there is no damage
R or sharp edges that could cause damage to the packing
R during installation or that could cause a leak.

(7) Push or slide the packing into position. Do not twist the packing when it is installed.

(8) Do not install packings on engine parts which are hot (hot parts will cause damage to a packing).

(9) Use an approved tool to install the packings on a part which has more than one packing groove (this is to prevent damage to the packing).

(10) Correctly align the mating parts when you assemble them to be sure not to accidentally cut the packing. Always push parts with packings straight on to the mating part when they are installed. This will make sure that the part does not twist as it is installed and will prevent subsequent damage to the packing.

Task 70-00-00-400-006:

1. Assembly and Installation of Fittings

A. Effectivity

(1) All (727/8D, 737/8D, Super 27/8D, DC-9/8D)

B. General

(1) This task gives the general instructions for the assembly and installation of fittings.

C. References

(1) Task 70-00-00-400-032, Standard Torques

D. Procedure - Assembly and Installation of Elbow and Positioning Type Fittings (Elbows)
See Figure 401.

(1) Always obey the specific procedures and limits in the specific AMM maintenance tasks.

(2) Apply the lubricant to the threads and packing as specified in the specific AMM maintenance task.

(3) Install the jamnut to the second set of threads on the elbow.

(4) Install the retainer and packing to the area between the two sets of threads.

(5) Turn the nut out only until the packing touches the first set of threads.

(6) Install the fitting assembly to the boss until the packing is in the beveled portion of the threaded hole.

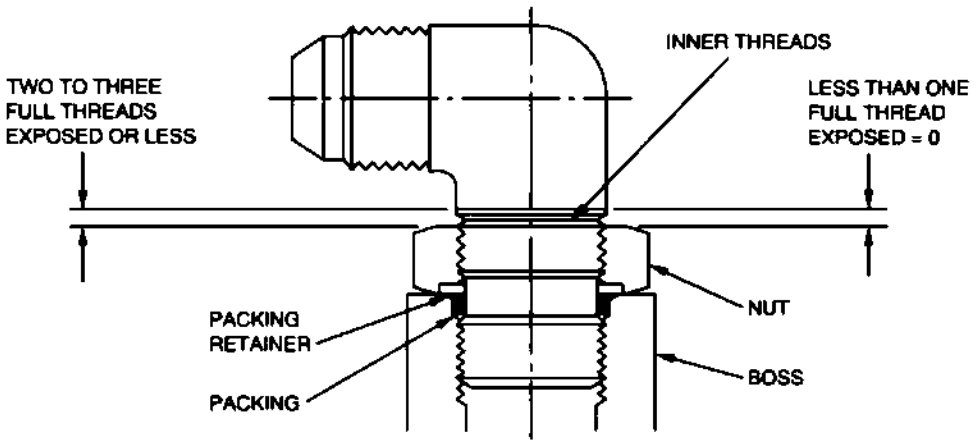
NOTE: You will turn the fitting and the nut together so that the nut does not turn in relation to the fitting. You will feel an increase in torque when the packing is in the correct position.

(7) While you hold the nut, turn the fitting clockwise into the boss one and one-half turns.

(8) While you hold the nut, turn the fitting no more than one-half turn to align the tube, hose, or manifold.

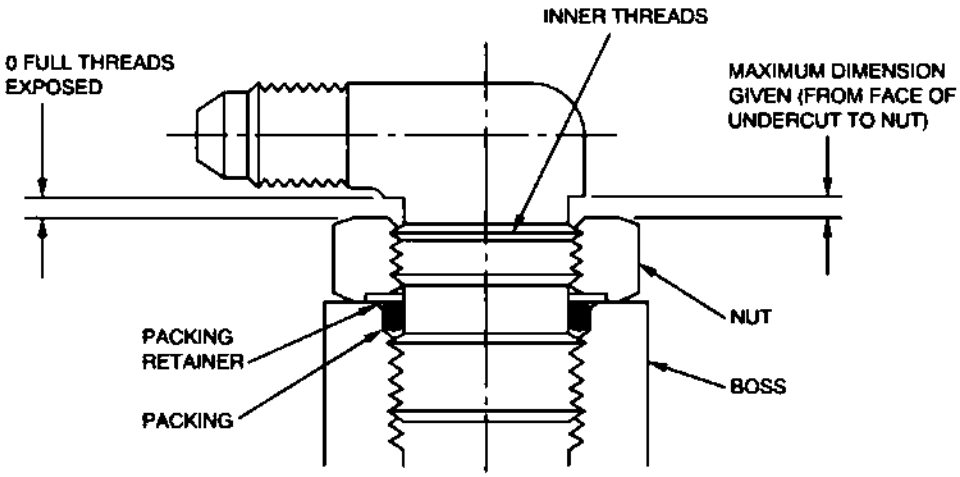
CAUTION: **BEFORE YOU TIGHTEN THE JAMNUT, INSTALL THE TUBE, HOSE, OR MANIFOLD HANDTIGHT TO MAKE SURE THAT THE ELBOW FITTING IS CORRECTLY ALIGNED. IF YOU DO NOT DO THIS, YOU CAN CAUSE STRESS TO THE TUBE AND SUBSEQUENT DAMAGE.**

(9) With the elbow correctly aligned, torque the jamnut as specified in the specific AMM maintenance task or the Standard Torques (Task 70-00-00-400-032).



A
TYPICAL POSITION AFTER INSTALLATION
(STANDARD FITTING)

$$\left(\text{THREADS EXPOSED} = \frac{0+1}{2} = 1/2\right)$$



B
TYPICAL POSITION AFTER INSTALLATION
(UNDERCUT FITTING)

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PW V

Assembly and
Installation of Fittings
Figure 401
(Task 70-00-00-400-006)

Task 70-00-00-400-007-001:

1. Installation of Tubes With Fixed (Brazed) Conical Seat Ferrules (37 Degree) (SPOP 426)

A. Effectivity

(1) All (727/8D, 737/8D, Super 27/8D, DC-9/8D)

B. General

(1) This task gives the general instructions for the correct installation of tubes with fixed (brazed) conical seat ferrules (37 degree).

C. References

(1) Task 70-00-00-400-032, Standard Torques

D. Equipment

(1) (No specific) Torque Wrench (as specified by the specific AMM maintenance task)

E. Consumable Materials

(1) (No specific) Oil or Lubricant (as specified by the specific AMM maintenance task)

F. Procedure - Method A - Typical Installation of Tubes [1] With Fixed (Brazed) Conical Seat Ferrules (37 Degree) See Figure 401.

(1) Always obey the specific procedures and limits in the specific AMM maintenance tasks.

(2) Remove all the protective covers from the tube [1] and mating adapters.

(3) Wipe clean the conical seats of the tube [1] and mating adapters.

(4) Examine the conical seats of the tube [1] and the mating adapters for any damage (such as, nicks, burrs, or wear). Replace, as necessary.

(5) Apply the necessary lubricant to the tube nut [2] threads and to the rear of the tube ferrules (nut loading surface).

(6) Remove any excess lubricant from the tube [1] threads and the conical seat areas.

(7) Install the tube [1] to the mating adapters and tighten the tube nuts [2] handtight only.

R NOTE: Make sure that the tube nuts are handtight and
R that the tube conical seat is fully against the
R adapter conical seat. To make sure, you can
R tighten the nut with a wrench until you can
R feel the seats touch and then loosen the nut
R one-quarter turn.

(8) Make sure the tube [1] is not bent and that the tube ends align with the mating adapters.

(9) Apply the necessary lubricant to the bolt [3] threads which attach the tube clamps [4].

(10) Attach all the clamps [4] and clamp bolts [3] handtight only.

(11) Make sure the installation of the clamps [4] and clamp bolts [3] do not stress or load the tube [1].

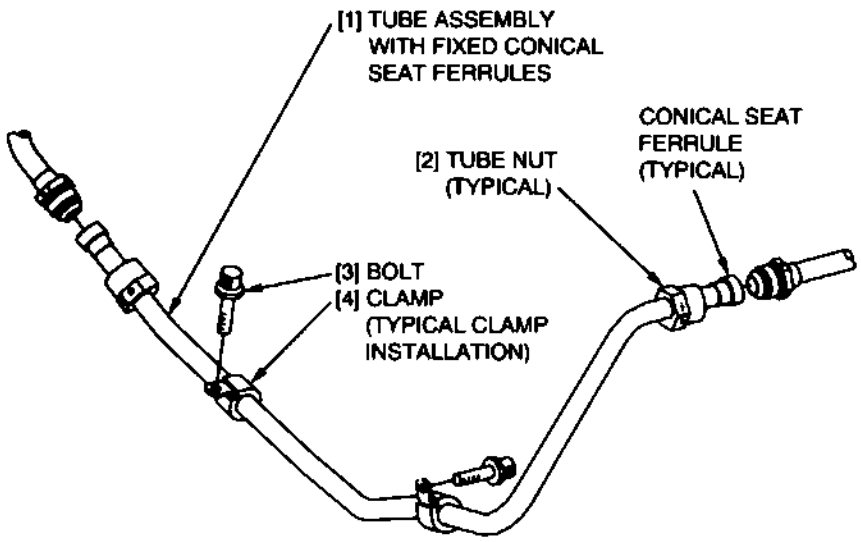
NOTE: When you install and torque clamp bolts [3] before the tube nuts [2], the tube [1] can turn on the conical seats to better align itself. This will put the tube [1] in the final position before you tighten the tube nuts [2] and will decrease any stress on the tube [1] adjacent to the ferrules.

(12) Torque the clamp bolts [3] to the correct torque while you make sure the clamps [4] do not turn, twist, or bend.

(13) While you hold the mating adapter with a wrench, torque the tube nut [2] at each end to the necessary torque. Refer to Standard Torques (Task 70-00-00-400-032).

(14) Examine the tube [1] ends for any evidence of tube twist or damage adjacent to the brazed ferrules. Replace, as necessary.

(15) Safety the tube nuts [2], where necessary.


[1] TUBE ASSEMBLY WITH FIXED CONICAL SEAT FERRULES
CONICAL SEAT FERRULE (TYPICAL)
[2] TUBE NUT (TYPICAL)
[3] BOLT
[4] CLAMP (TYPICAL CLAMP INSTALLATION)

G-11793 (0802)
PW V

Installation of Tubes With Fixed (Brazed) Conical Seat Ferrules (37 Degree)
Figure 401
(Task 70-00-00-400-007-001)

Task 70-00-00-400-007-002:

2. Installation of Hose and/or Tube Assemblies With Fixed or Loose Flange Ends (Used With Packings or Seal Plates) (SPOP 426)

A. Effectivity

(1) All (727/8D, 737/8D, Super 27/8D, DC-9/8D)

B. General

(1) This task gives the general instructions for the correct installation of hose and/or tube assemblies with fixed or loose flange ends (used with packings or seal plates).

C. References

(1) Task 70-00-00-400-032, Standard Torques

D. Equipment

(1) (No specific) Torque Wrench (as specified by the specific AMM maintenance task)

E. Consumable Materials

(1) (No specific) Oil or Lubricant (as specified by the specific AMM maintenance task)

F. Procedure - Method B - Typical Installation of Hose and/or Tube Assemblies [10] With Fixed or Loose Flange Ends (Used With Packings or Seal Plates)
See Figure 402.

CAUTION: MAKE SURE THAT YOU REMOVE ANY PROTECTIVE COVERS FROM INSIDE THE TUBE OPENINGS. THESE TYPES OF COVERS HAVE CAUSED IN-FLIGHT SHUTDOWNS WHEN ACCIDENTLY LEFT INSTALLED.

R CAUTION: BE CAREFUL WITH ALL TUBES THAT CONTAIN A FLEX
R DESIGN SEGMENT. BE SURE TO REMOVE AND INSTALL
R A TUBE WITH A FLEX SEGMENT WITH THE SAME
R PRECAUTIONS USED FOR A TUBE WITHOUT A FLEX
R SEGMENT. DO NOT BEND THE FLEXHOSE OF A TUBE
R TO HELP WITH THE REMOVAL OR INSTALLATION OF
R AN ATTACHED COMPONENT. IF YOU BEND A FLEX
R SEGMENT TOO MUCH, YOU CAN CAUSE A KINK IN
R THE EXTERNAL WIRE BRAID AND IN THE INNER
R POLYTETRAFLUOROETHYLENE (PTFE) TUBE, AND THE

R TUBE COULD BREAK OR HAVE LEAKS. A FLEXHOSE
R KINK CAN CAUSE A LARGE DECREASE IN FATIGUE
R STRENGTH. LOW FATIGUE STRENGTH CAN CAUSE THE
R WIRES IN THE WIRE BRAID TO BREAK DURING
R SUBSEQUENT ENGINE OPERATION.

(1) Always obey the specific procedures and limits in the specific AMM maintenance tasks.

(2) Remove all the protective covers from the tube [10] and mating adapters.

(3) Wipe clean the flange seats of the tube [10] and mating adapters.

(4) Examine the flange seats of the tube [10] and the mating adapters for any damage (such as, nicks, burrs, and wear). Replace, as necessary.

(5) Apply the necessary lubricant to the bolt [13], [17] threads which attach the tube flanges.

(6) Install any necessary packings [18] lubricated with the applicable lubricant.

(7) Carefully install the tube [10] and seal plates [11] to the mating adapters with the bolts [13] and nuts [12] handtight only.

(8) If applicable, make sure the packing [18] engaged the mating adapter fully without damage.

(9) Tighten the bolts [13], [17] and nuts [12], [16] at each end and loosen two turns.

(10) Apply the necessary lubricant to the bolt [14] threads which attach the tube clamps [15].

(11) Attach all the clamps [15] and clamp bolts [14] and tighten the clamp bolts [14] handtight only.

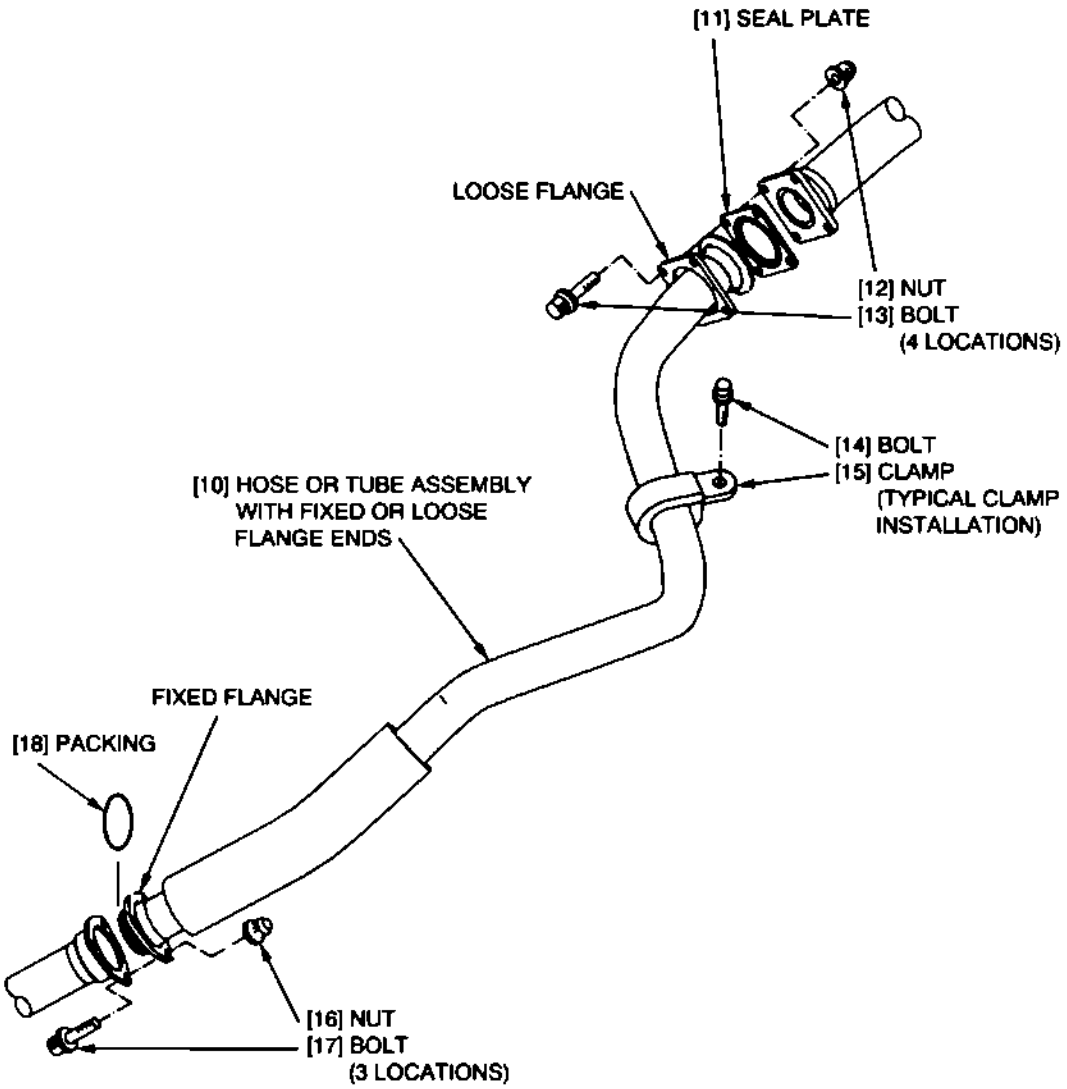
(12) Make sure the installation of the clamps [15] and clamp bolts [14] does not stress or load the tube [10].

NOTE: When you install and torque clamp bolts [14] before the tube end bolts [13], [17], the tube [10] can turn on the seats to better align itself. This will put the tube in final position before you tighten the tube bolts [13], [17] and will decrease any stress on the tube adjacent to the ferrules.

(13) Torque the clamp bolts [14] to the correct torque while you make sure the clamps [15] do not turn, twist, or bend.

(14) Torque the bolts [13], [17] and nuts [12], [16] at each end to the necessary torque. Refer to Standard Torques (Task 70-00-00-400-032).

(15) Examine the tube [10] for any tube damage or incorrect assembly. Replace, as necessary.



G-11794 (0802)
PW V

Installation of Hose and/or Tube Assemblies With Fixed or Loose Flange Ends (Used With Packings or Seal Plates)
Figure 402
(Task 70-00-00-400-007-002)

Task 70-00-00-400-007-003:

3. Installation of Tubes With Bolted Flanges (Used With Crush-Type Gaskets) (SPOP 426)

A. Effectivity

(1) All (727/8D, 737/8D, Super 27/8D, DC-9/8D)

B. General

(1) This task gives the general instructions for the correct installation of tubes with bolted flanges (used with crush-type gaskets).

C. References

(1) Task 70-00-00-400-032, Standard Torques

D. Equipment

(1) (No specific) Torque Wrench (as specified by the specific AMM maintenance task)

E. Consumable Materials

(1) (No specific) Oil or Lubricant (as specified by the specific AMM maintenance task)

(2) (P05-396) Paraffin Wax Blend (PMC 9462)

F. Procedure - Method C - Typical Installation of Tubes [20] With Bolted Flanges (Used With Crush-Type Gaskets) See Figure 403.

CAUTION: MAKE SURE THAT YOU REMOVE ANY PROTECTIVE COVERS FROM INSIDE THE TUBE OPENINGS. THESE TYPES OF COVERS HAVE CAUSED IN-FLIGHT SHUTDOWNS WHEN ACCIDENTLY LEFT INSTALLED.

(1) Always obey the specific procedures and limits in the specific AMM maintenance tasks.

(2) Remove all the protective covers from the tube [20] and mating bosses.

(3) Wipe clean the flange seats of the tube [20] and mating bosses.

(4) Examine the flange seats of the tube [20] and the mating bosses for any burrs or damage. Replace, as necessary.

(5) Apply the necessary lubricant to the bolt [22], [25] threads which attach the tube flanges.

(6) Install the necessary new gaskets [21] to the gasket groove in the tube [20] or mating boss flange. Use a small amount of (P05-396) Paraffin Wax Blend (PMC 9462) to hold in position.

(7) Carefully install the tube [20] to the mating bosses with the bolts [22], [25] handtight only.

(8) Apply the necessary lubricant to the bolt [23] threads which attach the tube clamps [24].

(9) Attach all the clamps [24] and clamp bolts [23] and tighten the clamp bolts [23] handtight only.

(10) Make sure the installation of the clamps [24] and clamp bolts [23] does not stress or load the tube [20].

(11) Torque the bolts [22], [25] at each end in small increments to the necessary torque

(12) Torque all the bolts [22], [25] again and until the same torque indication holds. Refer to Standard Torques (Task 70-00-00-400-032).

(13) Torque the clamp bolts [23] to the correct torque while you make sure the clamps [24] do not turn, twist, or bend.

(14) Examine the tube [20] for any tube damage or incorrect assembly. Replace, as necessary.

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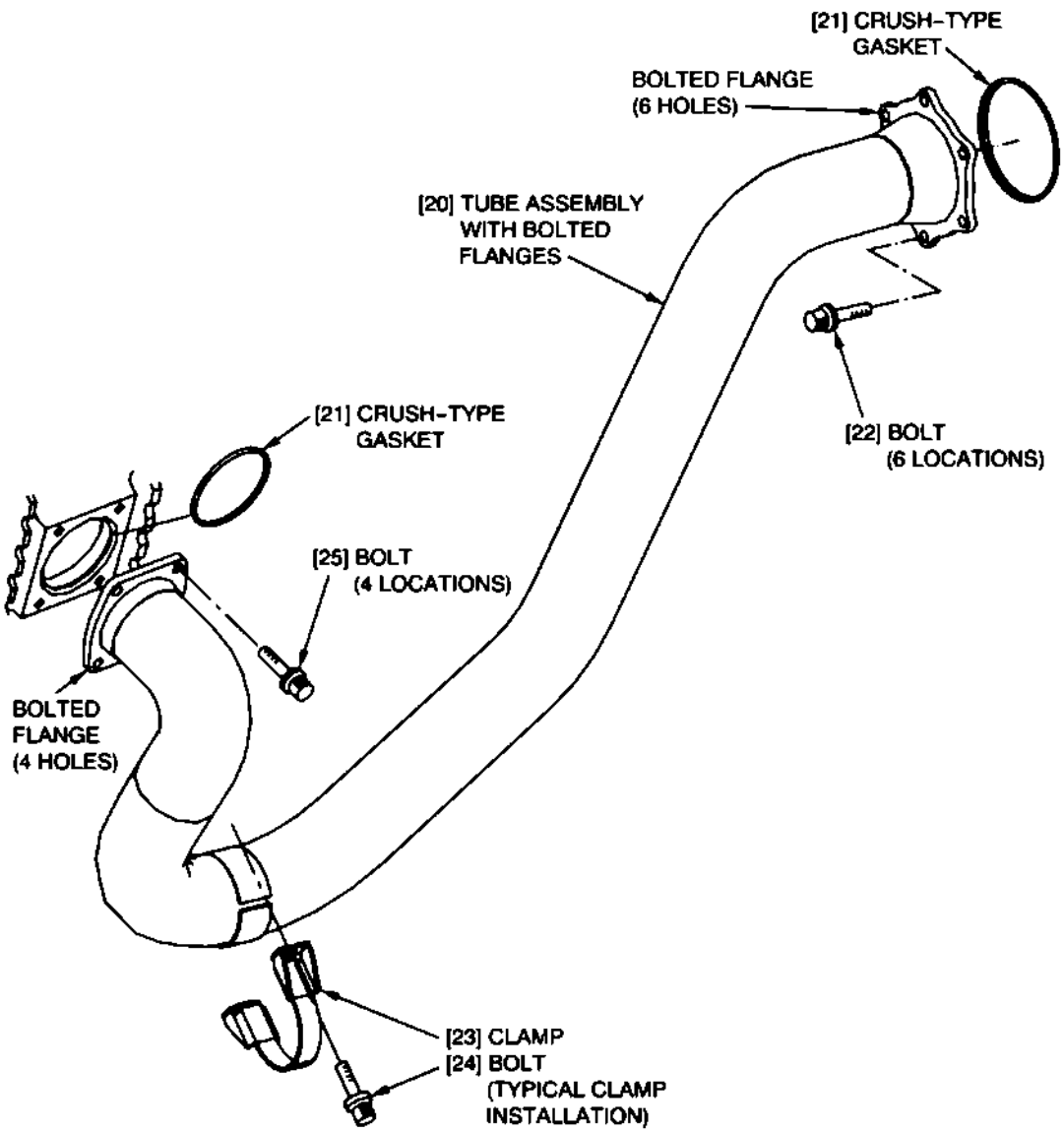

Installation of Tubes With Bolted Flanges (Used With Crush-Type Gaskets)
Figure 403
(Task 70-00-00-400-007-003)

Task 70-00-00-400-007-004:

4. Installation of Tubes With Flexible-Type Fittings (Used With Packings and Retainers) (SPOP 426)

A. Effectivity

(1) All (727/8D, 737/8D, Super 27/8D, DC-9/8D)

B. General

(1) This task gives the general instructions for the correct installation of tubes with flexible-type fittings (used with packings and retainers).

C. References

(1) Task 70-00-00-400-032, Standard Torques

D. Equipment

(1) (No specific) Torque Wrench (as specified by the specific AMM maintenance task)

E. Consumable Materials

(1) (No specific) Oil or Lubricant (as specified by the specific AMM maintenance task)

F. Procedure- Method D - Typical Installation of Tubes [30] With Flexible-Type Fittings (Used With Packings and Retainers)
See Figure 404.

CAUTION: MAKE SURE THAT YOU REMOVE ANY PROTECTIVE COVERS FROM INSIDE THE TUBE OPENINGS. THESE TYPES OF COVERS HAVE CAUSED IN-FLIGHT SHUTDOWNS WHEN ACCIDENTLY LEFT INSTALLED.

(1) Always obey the specific procedures and limits in the specific AMM maintenance tasks.

(2) Remove all the protective covers from the tube [30] and mating adapters.

(3) Wipe clean the tube [30] ends and mating adapters.

(4) Examine the tube [30] ferrules, tube ends, and mating adapters for any burrs or damage. Replace, as necessary.

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(5) Apply the necessary lubricant to the tube nut [35] threads.

(6) Remove any excess lubricant from the seal areas.

(7) Apply the necessary lubricant to the packings [34] and retainers [33].

NOTE: Some of these types of tubes [30] have loose (floating) ferrules [36]. Make sure the ferrules are installed before you install the packings [34].

CAUTION: BE SURE TO INSTALL A RETAINER WITH THE PACKING. IF THERE IS NO RETAINER, THE PACKING CAN PUSH OUT BETWEEN THE TUBE AND THE MATING ADAPTER. THIS CAN CAUSE PIECES OF PACKING MATERIAL TO GET INTO THE OIL OR FUEL SYSTEMS AND CAUSE ENGINE DAMAGE.

(8) Install the packing [34] and retainer [33] to each end of the tube against the ferrule [36].

(9) Install the tube [30] to the mating adapters and tighten the tube nuts [35] handtight only.

(10) Make sure the tube [30] is not bent and that the tube ends align with the adapters.

(11) Apply the necessary lubricant to the bolt [31] threads which attach the tube clamps [32].

(12) Attach all the clamps [32] and clamp bolts [31] and tighten the clamp bolts handtight only.

(13) Make sure the installation of the clamps [32] and clamp bolts [31] does not stress or load the tube [30].

CAUTION: MAKE SURE YOU PUT THE PACKING AGAINST THE FERRULE [36] AND ALIGN THE TUBE [30] BEFORE YOU TORQUE THE TUBE NUTS [35]. THIS PROCEDURE WILL PREVENT DAMAGE TO THE TUBE [30] AND/OR PACKING [34].

CAUTION: BE CAREFUL WHEN YOU TORQUE THE TUBE NUTS [35]. USE THE APPLICABLE TORQUE TABLE FOR

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THE CORRECT LIMITS. TOO MUCH TORQUE CAN DAMAGE THE TUBE [30] AND/OR PACKING [34].

(14) Torque the tube nuts [35] to the necessary torque limit. Refer to Standard Torques (Task 70-00-00-400-032).

NOTE: If the tube has a loose (floating) ferrule [36], torque the tube end with the loose ferrule [36] after you torque the end with the brazed ferrule.

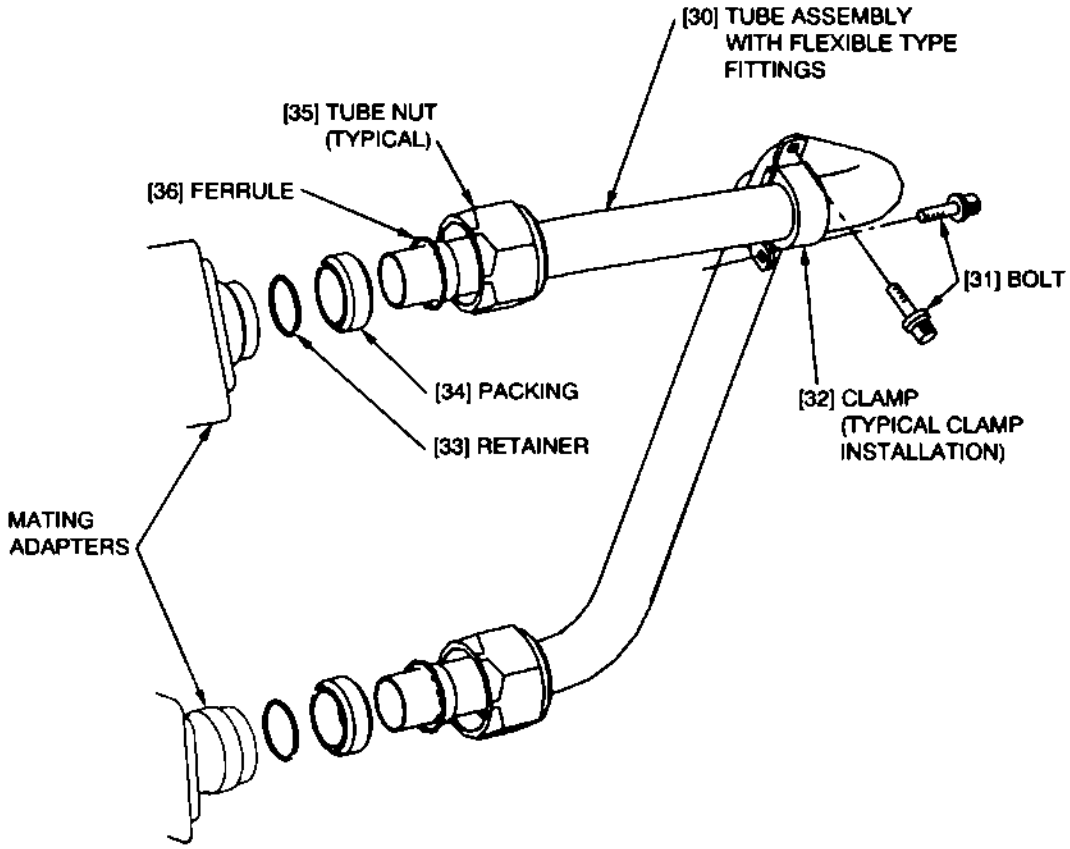
(15) Loosen the tube nuts [35] one turn.

(16) Torque the tube nuts [35] again to the necessary torque limit. Refer to Standard Torques (Task 70-00-00-400-032).

(17) Torque the clamp bolts [31] to the correct torque while you make sure the clamps [32] do not turn, twist, or bend.

(18) Examine the tube [30] ends for any evidence of tube twist or damage adjacent to the tube nuts [35]. Replace, as necessary.

(19) Safety the tube nuts [35].



G-11796 (0802)
PW V

Installation of Tubes With Flexible-Type Fittings (Used With Packings and Retainers)
Figure 404
(Task 70-00-00-400-007-004)

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Task 70-00-00-400-007-005:

5. Installation of Tubes With Concentric Type Fittings (Double Wall Tubes) (SPOP 426)

A. Effectivity

(1) All (727/8D, 737/8D, Super 27/8D, DC-9/8D)

B. General

(1) This task gives the general instructions for the correct installation of tubes with concentric-type fittings (double wall tubes).

C. References

(1) Task 70-00-00-400-032, Standard Torques

D. Equipment

(1) (No specific) Torque Wrench (as specified by the specific AMM maintenance task)

E. Consumable Materials

(1) (No specific) Oil or Lubricant (as specified by the specific AMM maintenance task)

(2) (P05-396) Paraffin Wax Blend (PMC 9462)

F. Procedure - Method E - Typical Installation of Tubes [40] With Concentric-Type Fittings (Double Wall Tubes) See Figure 405.

CAUTION: MAKE SURE THAT YOU REMOVE ANY PROTECTIVE COVERS FROM INSIDE THE TUBE OPENINGS. THESE TYPES OF COVERS HAVE CAUSED IN-FLIGHT SHUTDOWNS WHEN ACCIDENTLY LEFT INSTALLED.

(1) Always obey the specific procedures and limits in the specific AMM maintenance tasks.

(2) Remove all the protective covers from the tube [40] and mating adapters.

(3) Wipe clean the tube [40] ends and mating adapters.

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(4) Examine the tube [40] ferrules, tube ends, and mating adapters for any burrs or damage. Replace, as necessary.

(5) Apply the necessary lubricant to the outer tube nut [43] threads.

(6) Apply the necessary lubricant to the inner tube nut [45] threads.

(7) Remove any excess lubricant from the seal areas.

(8) Apply the necessary lubricant to the packings [46].

(9) Install the new packing [46] into the packing groove of the inner fitting at each end of the tube.

(10) Install the new gaskets [44] into the groove of the outer nut at each end of the tube. Use a small amount of (P05-396) Paraffin Wax Blend (PMC 9462) to hold in position.

(11) Install the tube [40] to the mating adapters and tighten the inner tube nuts [45] handtight only.

R NOTE: Make sure that the tube nuts are handtight and
R that the tube conical seat is fully against the
R adapter conical seat. To make sure, you can
R tighten the nut with a wrench until you feel the
R seats touch and then loosen the nut one-quarter
R turn.

(12) Make sure the tube [40] is not bent and that the tube ends align with the adapters.

(13) Apply the necessary lubricant to the bolt [41] threads which attach the tube clamps [42].

(14) Attach all the clamps [42] and clamp bolts [41] and tighten the clamp bolts handtight only.

(15) Make sure the installation of the clamps [42] and clamp bolts [41] does not stress or load the tube [40].

(16) Torque the clamp bolts [41] to the correct torque while you make sure the clamps [42] do not turn, twist, or bend.

CAUTION: BE CAREFUL WHEN YOU TORQUE THE INNER TUBE NUTS [45]. USE THE APPLICABLE TORQUE TABLE FOR THE CORRECT LIMITS. TOO MUCH TORQUE CAN DAMAGE THE TUBE [40].

(17) Torque the tube inner nuts [45] to the necessary torque limits as follows. Refer to Standard Torques (Task 70-00-00-400-032).

(a) Torque the inner nut [45] at each end of the tube to the specified torque while you hold the inner nut at the opposite end of the tube with a wrench.

(b) Without loosening, torque the inner nuts [45] at each end of the tube to the specified torque while you hold the inner nut at the opposite end of the tube with a wrench.

(c) If the inner nut at either end of the tube does not maintain torque after four times, replace the tube assembly [40].

(18) Examine the inner tube [40] ends for any evidence of tube twist or damage adjacent to the inner tube nuts [45]. Replace as necessary.

(19) Do the leak test of the inner tube connections as specified in the specific AMM maintenance task.

(20) Safety the inner tube nuts [45] to the inner ferrules.

(21) Make sure that the gaskets [44] are installed on the outer tube nuts [43].

(22) Tighten the outer tube nuts [43] handtight only.

(23) Torque the outer tube nuts [43] to the necessary torque limits as follows. Refer to Standard Torques (Task 70-00-00-400-032).

(24) Examine the outer tube [43] ends for any evidence of tube twist or damage adjacent to the outer tube nuts [43]. Replace as necessary.

(25) Safety the tube nuts [43].

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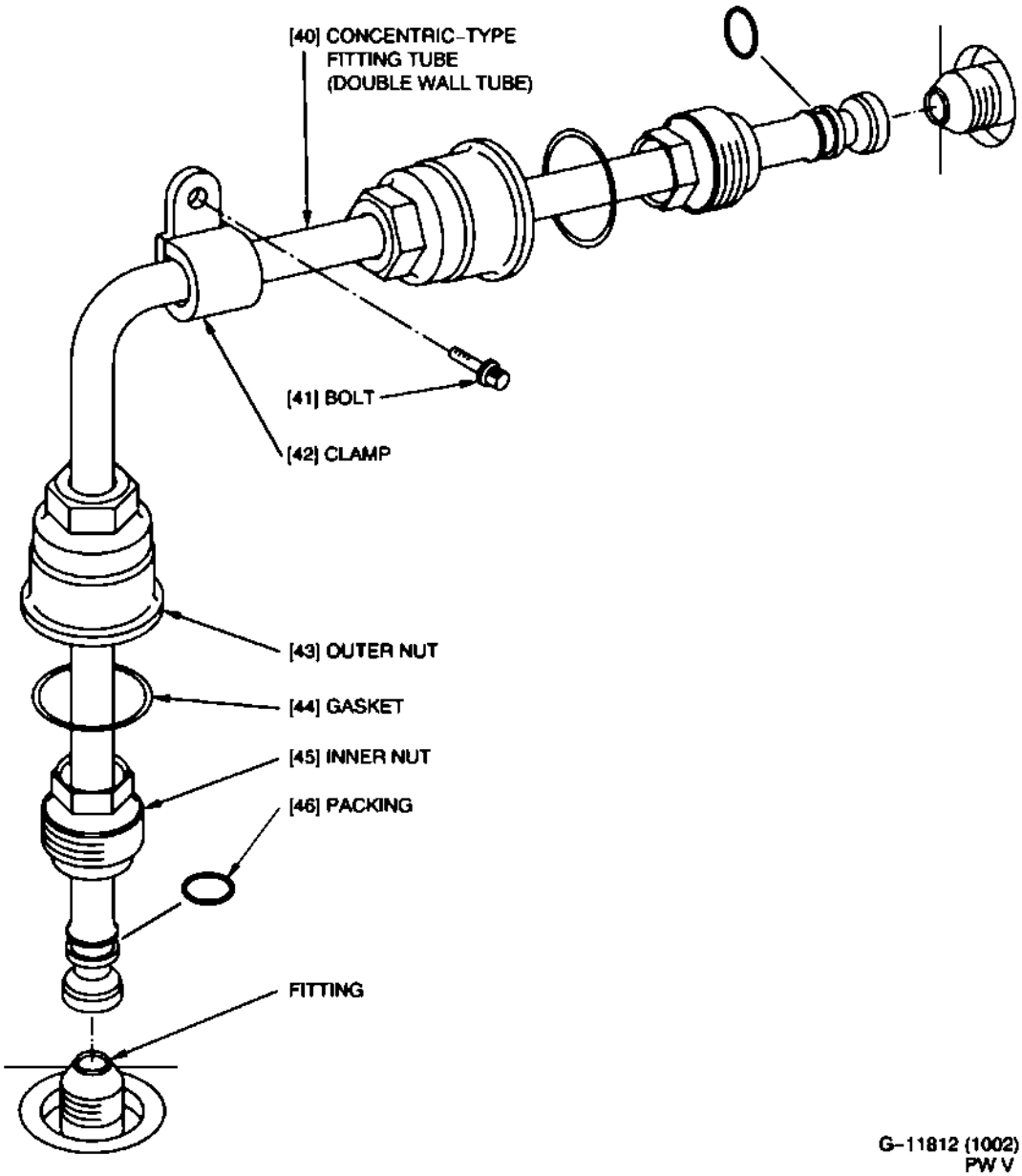


Installation of Tubes
With Concentric-Type
R Fittings (Double Wall Tubes)
R Figure 405 #70-00-00
(Task 70-00-00-400-007-005) REM/INST-07

Task 70-00-00-400-020:

1. Installation of Electrical Harnesses, Leads, and Cables

A. Effectivity

(1) All (727/8D, 737/8D, Super 27/8D, DC-9/8D)

B. References

(1) Task 70-00-00-100-020, Cleaning of Electrical Wiring Harnesses and Contact Points (SPOP 6)

(2) Task 70-00-00-400-032, Standard Torques

C. Equipment

(1) (No specific) Glenair (Electrical Connector) Soft Jaw Pliers - TG-69

(2) (No specific) Glenair (Electrical Connector) Strap Wrench - TG-70

D. Procedure - General Harness Installation Instructions

(1) Always obey the procedures and limits in the applicable AMM maintenance tasks.

CAUTION: REMOVE THE PROTECTION COVERS FROM THE OPENINGS AS NECESSARY TO PREVENT ENGINE DAMAGE.

(2) Make sure that you remove protection covers as necessary to prevent engine damage.

(3) Examine each harness electrical connector and the mating component receptacle as follows.

(a) Examine for broken, bent, or corroded pins.

(b) Examine for arcing between the pins or sockets.

(c) Examine the threads.

(d) Examine the backshells and backshell clamps for damage and tightness.

(4) Clean the electrical harness connectors and the contacts. Refer to Cleaning of Electrical Harnesses and Contact Points (SPOP 6) (AMM TASK 70-00-00-100-020).

(5) Examine the harness wires for cracks, wear, or breaks.

CAUTION: DO NOT BEND OR TWIST THE HARNESS TOO MUCH. IF YOU DO, DAMAGE TO THE HARNESS CAN OCCUR.

CAUTION: DO NOT TIGHTEN THE CLAMPS UNTIL YOU CONNECT ALL ELECTRICAL CONNECTORS AND THE HARNESS IS IN THE CORRECT POSITION. IF YOU DO NOT DO THIS, DAMAGE TO THE HARNESS CAN OCCUR.

CAUTION: DO NOT LET THE WEIGHT OF THE HARNESS HANG ON THE CONNECTORS. IF YOU DO, DAMAGE TO THE HARNESS CAN OCCUR.

(6) Install the wiring harness assembly as follows.

(a) Put the harness in position on the engine as follows.

1 Start at the top, continue to work down and around the engine, and put the harness in position on any hinge clamps, block clamps, or brackets as applicable.

a Do not twist the harness.

b Do not close or tighten any clamps at this time.

CAUTION: USE THE CORRECT ASSEMBLY PROCEDURE AND TOOLS FOR THE HARNESS CONNECTOR INSTALLATION. IF YOU DO NOT, A DAMAGED OR LOOSE CONNECTOR CAN OCCUR. A LOOSE CONNECTOR CAN AFFECT ENGINE OPERATION, LIGHTENING PROTECTION, AND CAUSE AN IN FLIGHT SHUTDOWN.

(7) Connect self-locking (MIL-C-26500 or MIL-C-38999) harness electrical connectors to the mating components as follows.

(a) Examine, align, and engage the connector.

(b) Push lightly inward on the connector while tightening the coupling ring.

(c) Use the Glenair TG-69 Soft Jaw Pliers or the Glenair TG-70 Strap Wrench to tighten the connector against the receptacle.

(d) While you tighten, push the connector in and from side to side.

(e) Make sure you can feel the ratchet feature.

(f) Tighten the connector until the pliers or strap wrench slip on the connector ring.

(g) Make sure that you cannot tighten the connector more.

NOTE: When you use these tools correctly, the contacts are sufficiently engaged and the connector is tight. If you use too much force, these tools will turn on the connector coupling nut. (This is to protect the connector from too much torque.)

CAUTION: USE THE CORRECT ASSEMBLY PROCEDURE AND TOOLS FOR THE HARNESS CONNECTOR INSTALLATION. IF YOU DO NOT, A DAMAGED OR LOOSE CONNECTOR CAN OCCUR. A LOOSE CONNECTOR CAN AFFECT ENGINE OPERATION, LIGHTENING PROTECTION, AND CAUSE AN IN FLIGHT SHUTDOWN.

(8) Connect other types of harness electrical connectors to the mating components as follows.

(a) Examine, align, and engage the connector.

(b) Push lightly inward on the connector while tightening the coupling ring.

(c) Use the Glenair TG-69 Soft Jaw Pliers or the Glenair TG-70 Strap Wrench to tighten the connector against the receptacle.

(d) While you tighten, push the connector in and from side to side.

(e) Tighten the connector until the pliers or strap wrench slip on the connector ring.

(f) Make sure that you cannot tighten the connector more.

NOTE: When you use these tools correctly, the contacts are sufficiently engaged and the connector is tight. If you use too much force, these tools will turn on the connector coupling nut. (This is to protect the connector from too much torque.)

(g) If necessary, torque the connector as specified in the specific AMM maintenance task.

(h) If necessary, safety the connector coupling ring.

(9) Attach any harness terminal ends to the thermocouple or temperature probe studs with the specified washers and nuts.

(a) With the leads in the correct position, torque the nuts to limits in the specific AMM maintenance task or the Standard Torques (Task 70-00-400-032).

(10) Attach the harness to the engine as follows.

(a) Adjust the harness in the hinged clamps, loop clamps, and block clamps to remove any stress (too loose or too tight) and make sure of the clearances to adjacent hardware.

(b) Distribute the slack in the harness equally.

(c) Make a large radius where the harness changes direction.

(d) Attach the harness to the engine with the applicable hinged clamps, loop clamps, and block clamps as applicable.

(e) Torque the clamp bolts.

(11) Examine the assembly for foreign objects, damage, and correct assembly.

Task 70-00-00-400-022:

1. Enhancement of Electrical Wiring Harness Contact Points (SPOP 430)

A. Effectivity

(1) All (727/8D, 737/8D, Super 27/8D, DC-9/8D)

B. General

(1) This task gives the general instructions and the approved materials for enhancement of electrical wiring harness contact points.

R (2) Electrical contact enhancer on connector contacts in
R connector interfaces decreases intermittent signals
R that are apparently not correct, and/or nuisance
R messages.

R (3) This electrical contact enhancer is not an alternative
R to contact replacement. It is necessary to replace
R worn or damaged connectors as soon as the harness is
R at a location where it is possible to replace the
R connectors.

C. References

(1) Task 70-00-00-100-020, Cleaning of Electrical Wiring Harnesses and Contact Points (SPOP 6)

(2) Task 70-00-00-400-020, Installation of Electrical Harnesses, Leads and Cables.

D. Consumable Materials

NOTE: The P- numbers shown in this list are used by other Pratt & Whitney engine programs and are included to keep this list common with those in other engine and airframe programs.

(1) (P11-068) Electrical Contact Enhancer (SPMC 205)

(2) (P11-014A) Reagent Grade Isopropyl Alcohol (PMC 9016)

E. Procedure - Cleaning Instructions

(1) Always obey the procedures and limits in the applicable AMM maintenance tasks.

R (2) Clean and dry the connectors, if the connectors are
R not clean or dry. Refer to Cleaning of the Electrical Wiring Harnesses and Contact Points (SPOP 6) (AMM TASK 70-00-00-100-200).

R (3) Apply one drop of (P11-068) Electrical Contact Enhancer
R (SPMC 205) to the brush that the manufacturer supplies
R with the electrical contact enhancer and then use the
R brush to apply a thin layer of the electrical contact
R enhancer to the electrical contact pins on the male
R connector of the mating pair of electrical connectors.

R NOTE: Do not apply (P11-068) Electrical Contact
R Enhancer (SPMC 205) to igniter high tension lead
R contacts, EGT harness connections, or EGT
R junction box connections. The temperature of
R these connections could increase to higher
R than 425°F (218°C) decomposition temperature
R of (P11-068) Electrical Contact Enhancer (SPMC
R 205).

R (a) If the ambient temperature is too cold for the
R electrical contact enhancer to flow sufficiently,
R add (P11-014A) Reagent Grade Isopropyl Alcohol
R (PMC 9016) to the electrical contact enhancer in a
R proportion of 4:1 maximum (that is, four parts
R or less isopropyl alcohol to one part electrical
R contact enhancer) to make the electrical contact
R enhancer more liquid.

R (b) If you added alcohol to the electrical contact
R enhancer, let the applied electrical contact
R enhancer on the connector dry for one hour minimum
R before you connect the connectors.

R (4) Connect the mating connectors. Refer to Installation of Electrical Harnesses, Leads, and Cables (AMM TASK 70-00-00-400-020).

Task 70-00-00-400-030:

1. Tightening Torques

A. Effectivity

(1) All (727/8D, 737/8D, Super 27/8D, DC-9/8D)

B. General

(1) This task gives the general instructions for the torquing of engine fasteners and parts (bolts, nuts, fittings, and tubes).

C. References

(1) Task 70-00-00-400-031, Torque Indication Devices (Torque Wrenches)

(2) Task 70-00-00-400-032, Standard Torques

D. Procedure - General Torque Instructions

(1) Always obey the specific procedures and limits in the specific AMM maintenance tasks.

(2) Torque values to be used for J threads are identical to torques applied to standard threads.

(3) Torque limits listed in this section shall be interpreted as follows:

(a) Torque values in pound-inches (Newton meters) - lbf-in (N.m).

(b) Angles of turn in degrees.

(c) Stretch values in inches (mm).

(4) If part to be tightened is hot, allow sufficient time to elapse to allow temperature of part to reach a temperature equilibrium with surrounding area before final torquing.

(5) Use caution when you join flanges or mating sections during assembly. When you join snap fits, it is essential that mating parts be correctly seated prior to application of final torque. Unless specific procedures are provided in assembly instructions, parts should be seated by installing several bolts at regular

intervals then applying uniform torque where required to seat the mating surfaces. Once seating is assured, all bolts should be torqued to approximately 75 percent of final torque in a uniform stagger (180, 90, and 45 degree intervals, etc.) to prevent local overstressing of the bolts or flange. Final torque should be applied in same sequence.

(6) Torque applications should be done slowly and evenly for consistency and best possible accuracy. There may be instances, other than specific torque limits, where it is obvious that standard torque required should not be used due to the material or design of the engine part. Use common sense and good judgment in such cases.

(7) Refer to Torque Indication Devices (Torque Wrenches) (Task 70-00-00-400-031) for the correct size and use of torque wrenches and torque adapters.

(8) Refer to Standard Torques (Task 70-00-00-400-032) for standard torque recommendations.

Task 70-00-00-400-031:

1. Torque Indication Devices (Torque Wrenches)

A. Effectivity

(1) All (727/8D, 737/8D, Super 27/8D, DC-9/8D)

B. General

(1) This task gives the general instructions for:
The calibration of torque wrenches.
The correct selection of torque wrenches.
The calculations for torque indications when you use a torque adapter.

C. References

(1) Task 70-00-00-400-032, Standard Torques

D. Procedure - Torque Indication Devices

NOTE: Torque indicating devices are referred to as torque wrenches.

(1) Always obey the specific procedures and limits in the specific AMM maintenance tasks.

(2) Make sure that the torque wrench is calibrated.

(3) Calibrate all torque wrenches as follows.

(a) Inspect and calibrate all torque indicating devices by the schedule which follows.

1 Manual Non-Set Type Torque Wrenches (Beam Type) - 39 weeks

2 Manual Set Type Torque Wrenches (Click Type) - 39 weeks

3 Hydraulic Wrenches - 39 weeks

(b) Do all torque wrench calibrations with a calibrated weight and measured lever arm device to make sure of an accurate calibration.

(c) Do not compare one torque wrench to another torque wrench for accurate calibration.

(d) Always hold and use a torque wrench as specified in the manufacturer's instructions for accurate torque indications.

(4) Use the correct size torque wrench as follows.

(a) Select the correct size torque wrench so that the specified torque is between 25% and 95% of the torque wrench maximum indication.

(b) Use the torque wrench that will have the best and most accurate indication graduations.

(5) Use a torque wrench and extension (torque adapter) as follows. See Figure 401.

NOTE: Torque extensions are referred to as torque adapters.

(a) There are many situations which require you to use a torque adapter. When you use a torque adapter you must calculate the torque wrench indication so that you apply the specified torque to the fastener.

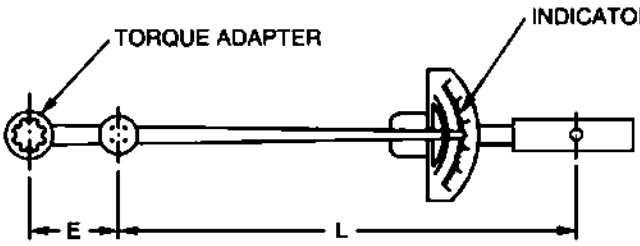
(b) When you install a torque adapter to a torque wrench you can change the effective beam length of the torque wrench. You can install the torque adapter in three ways. When you change the effective beam length, you must calculate the torque wrench indication so that you apply the specified torque to the fastener.

1 For the installation of a torque adapter which increases the effective beam length, calculate the indicated torque value using Method A. See Figure 402 (Sheet 1).

2 For the installation of a torque adapter which decreases the effective beam length, calculate the indicated torque value using Method B. See Figure 402 (Sheet 2).

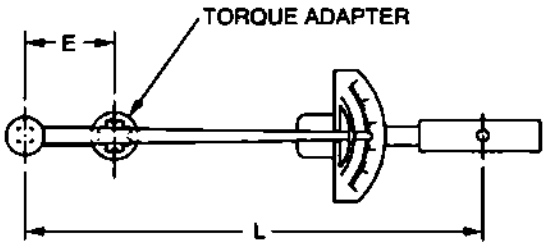
3 For the installation of a torque adapter which does not effect beam length, no calculation is necessary.

(6) Refer to Standard Torques (Task 70-00-00-400-032) for standard torque recommendations.



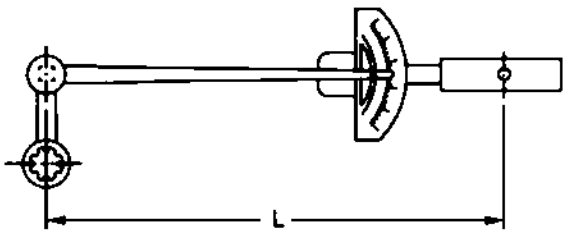
USE INDICATED TORQUE CALCULATION METHOD A.

INCREASED EFFECTIVE BEAM LENGTH



USE INDICATED TORQUE CALCULATION METHOD B.

DECREASED EFFECTIVE BEAM LENGTH

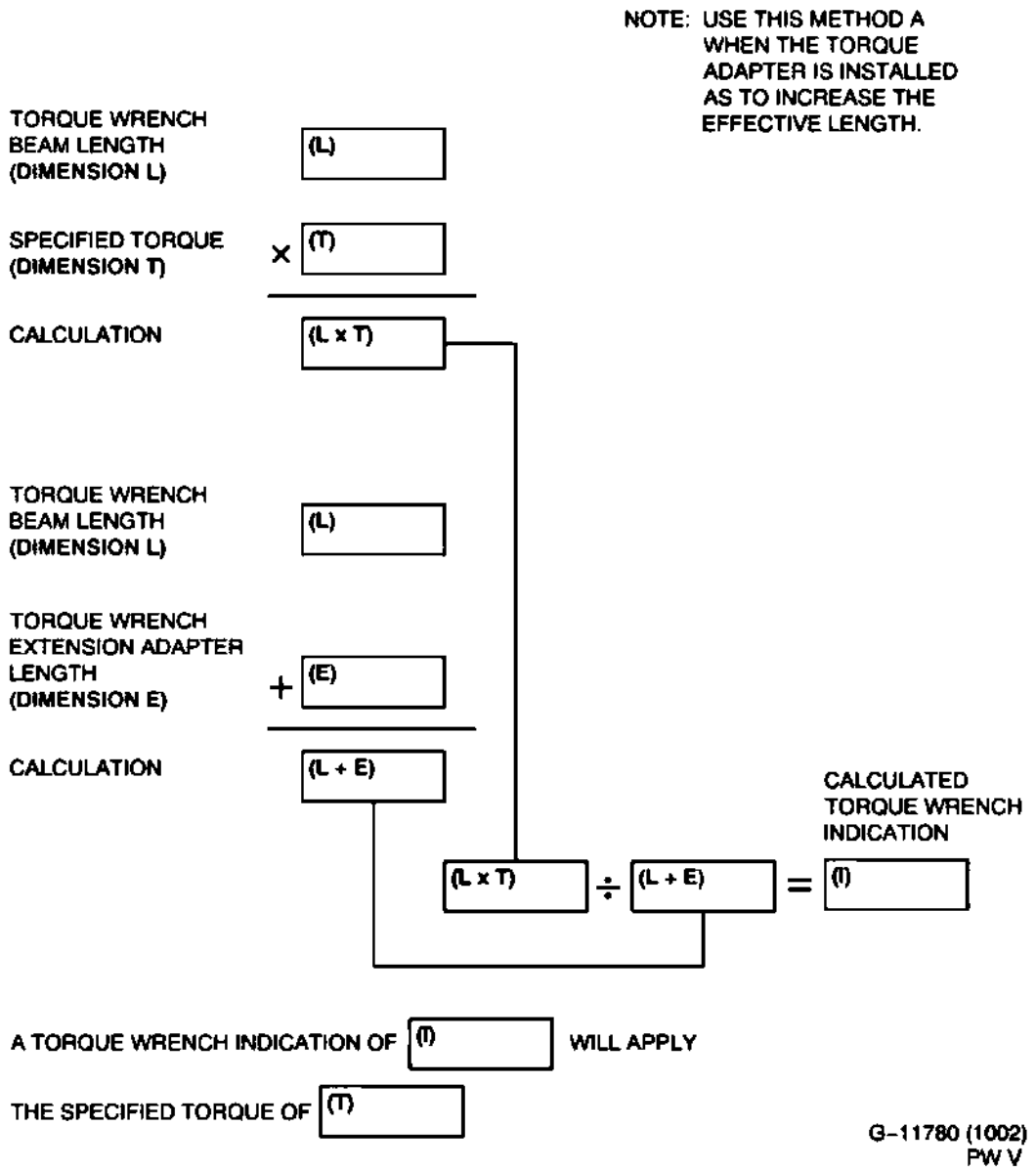


NO TORQUE CALCULATION IS NECESSARY. THE ADAPTER HAS NO EFFECT ON INDICATED TORQUE.

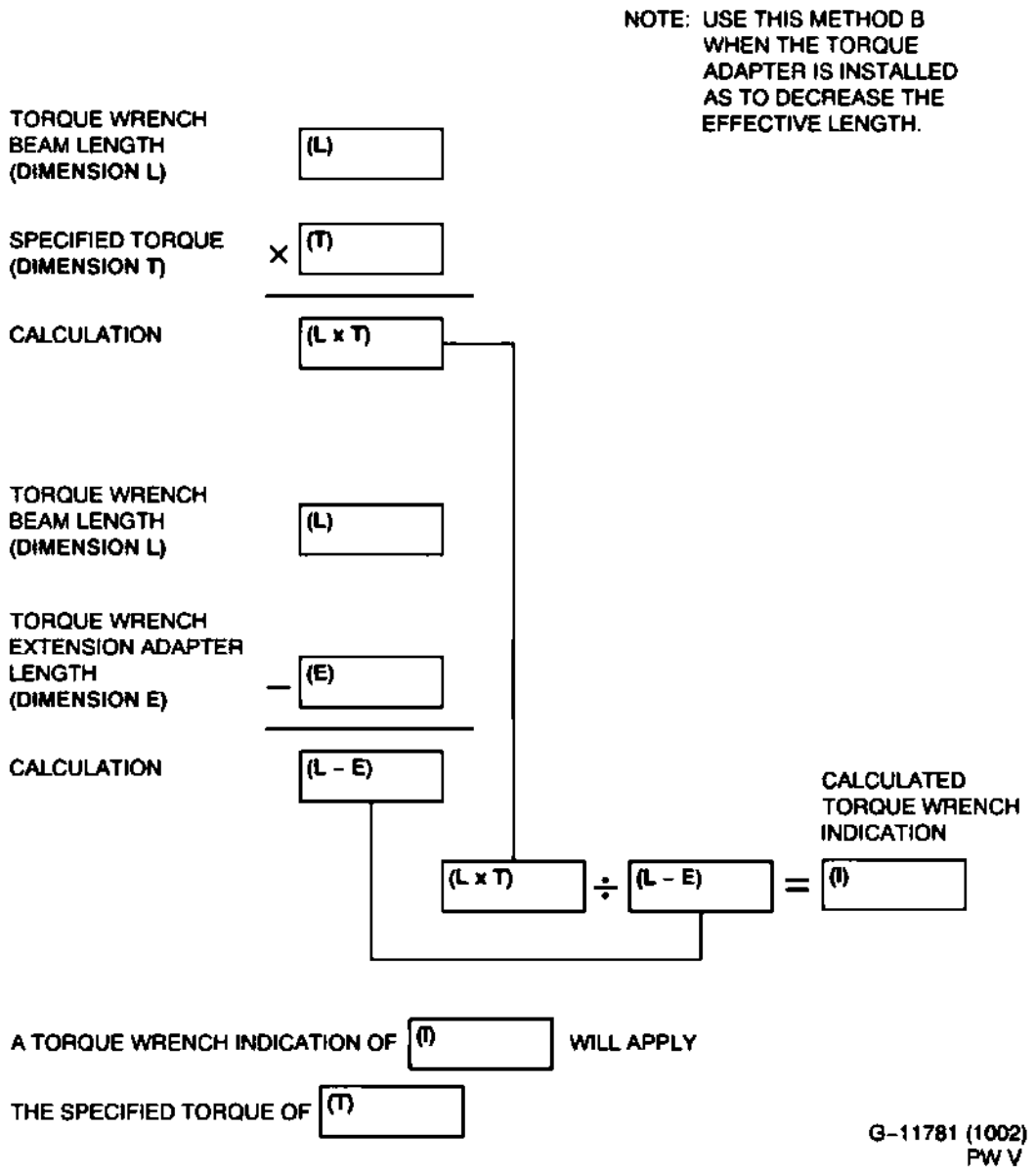
UNCHANGED BEAM LENGTH

G-00512 (0802)
PW V

Torque Indication Devices
(Torque Adapter Configurations)
Figure 401
(Task 70-00-00-400-031)



Torque Indication Devices
(Torque Calculation - Method A)
Figure 402 (Sheet 1)
(Task 70-00-00-400-031)



Torque Indication Devices
(Torque Calculation - Method B)
Figure 402 (Sheet 2)
(Task 70-00-00-400-031)

Task 70-00-00-400-032:

1. Standard Torques

A. Effectivity

(1) All (727/8D, 737/8D, Super 27/8D, DC-9/8D)

B. General

(1) This task gives the general instructions for:
- Lubricants and lubrication.
- Free-spinning fastener torques.
- Self-locking fastener torques.
- Steel pipe plug torques.
- Hex-head straight threaded fitting torques.
- Various tube type torques.
- Jamnut torques.
- Electrical component fastener torques.
- Klincher locknut torques.

C. References

(1) Task 70-00-00-400-007-001, Installation of Tubes With Fixed (Brazed) Conical Seat Ferrules (SPOP 426)

(2) Task 70-00-00-400-007-004, Installation of Tubes With Flexible-Type Fittings (Used With Packings and Retainers) (SPOP 426)

(3) Task 70-00-00-400-007-005, Installation of Tubes With Concentric-Type Fittings (Double Wall Tubes)

(4) Task 70-00-00-910-006, Check for Reuse of Self-locking Fasteners

D. Equipment

(1) (No specific) Torque Wrench (as specified by the specific AMM maintenance task)

E. Consumable Materials

NOTE: The P- numbers in this list are used by other Pratt & Whitney engine programs and are included to keep this list common with those in other engine and airframs programs.

(1) (P03-001) Engine Oil (PWA 521)

(2) (No specific) Oil or Lubricant (as specified by the specific AMM maintenance task)

F. Procedure - General Torque Instructions

(1) Always obey the specific procedures and limits in the specific AMM maintenance tasks.

(2) It is recommended that the nut be turned rather than the bolt wherever possible.

(3) If you turn the bolt, do as follows to get the correct tension and to prevent any scoring of a bolt, bolthole, or bearing surface.

(a) The bolt (this includes close tolerance shank bolts) must pass freely through aligned holes.

(b) Where the flange material is soft (for example, aluminum and magnesium), an Engineering-specified washer must be present under the bolt head.

(c) The bolt head bearing surface must be lubricated.

G. Lubricants And Lubrication

(1) Unless specified differently, torque values listed in this section apply when lubrication is applied to at least one of each pair of surfaces that will experience rubbing contact during the torquing process. (P03-001) Engine Oil (PWA 521) lubrication must be used unless antigalling/antiseize compound is used.

(2) The application of both oil and antigallant on the same pair of surfaces is not permitted. Apply the correct lubricant as specified in the specific AMM maintenance task.

(3) Torque For Oil Lubricated Parts (Except Studs)

(a) Torque limits for oil lubricated parts apply specifically to the use of (P03-001) Engine Oil (PWA 521) on the parts.

(4) Torque For Antigallant Lubricated Parts

(a) Torque limits for antigallant lubricated parts apply specifically to the use of compounds listed in the specific AMM maintenance task.

H. Free-Spinning Fasteners
See Figure 401.

(1) General

(a) Torque values specified in Figure 401 for nuts, bolts, and screws have been established to provide sufficient preload without overstressing the parts and are based on materials having minimum ultimate tensile strengths of 125,000 psi (861,844.6 kPa), equivalent to a hardness of 26HRC for steel parts.

(b) The torque values specified in Figure 401 apply to bolts in standard helical coil inserts as long as full thread engagement of the insert is accomplished.

(2) Thin Nuts, Slotted Nuts

(a) The torque values specified in Figure 401 shall apply to nuts where the height of the nut is greater than 75 percent of the major diameter of the thread.

(b) For thin nuts, where the height of the nut is 40 - 75 percent of the size of the major diameter, reduce the torque values 50 percent.

(c) For slotted nuts, the height shall be taken as the distance from the washer face to the bottom of the slots.

(d) Values do not apply to hollow bolts and screws.

(3) Lockwire and Cotter Pin Requirements

(a) After you tighten and correctly torque a castle nut, screw, or bolt, do not loosen to get the necessary alignment of cotter pin holes or wire holes.

(b) If the holes or slots are not correctly aligned at the minimum torque limit, tighten the fastener more until there is correct alignment. Do not exceed the maximum torque limit.

(c) If you cannot get the correct alignment, loosen the fastener one half a turn, then retorque.

(d) If you cannot get the correct alignment, replace the fastener with a different one.

I. Self-Locking Nuts
See Figure 402.

NOTE: Refer to Check for Reuse of Self-locking Fasteners (Task 70-00-00-910-006) to check the self-locking features of the fasteners.

(1) Free-Spinning Locknuts

(a) A free-spinning locknut is a nut that spins freely on the bolt until it contacts the mating surface. Additional torque causes activation of the locking feature. Use the free-spinning torque values specified in Figure 402.

(2) Prevailing Torque-Type Locknuts

(a) A prevailing torque-type locknut is a nut that spins freely on the bolt until the bolt enters the locking portion of the nut. The bolt interferes with the deformed section of the nut to cause a tight frictional hold on the bolt threads. Use the torque values specified in Figure 402, except when nut is on a stud. When the self-locking nut is on a stud, use the free-spinning torque values specified in Figure 401.

NOTE: Helical coil self-locking inserts are categorized as prevailing torque-type locknuts. The torques for bolts used in such inserts are specified in Figure 402.

J. Steel Pipe Plugs in Aluminum and Magnesium Cases
See Figure 403.

(1) The torque values for steel pipe plugs in aluminum and magnesium cases are specified in Figure 403. These values give sufficient torque to prevent leakage without overstressing the cases. If the pipe plug leaks after the specified torque is applied, do not torque to more than the values specified. Remove the plug, tighten and torque to the specified values again. If necessary, replace the plug with a different one.

(2) When you tighten plugs in a hot engine, reduce the specified torque by 20 percent to allow for the difference in expansion between steel plugs and aluminum or magnesium cases.

K. Hex-head Straight Threaded Fittings and Plugs
See Figure 403.

CAUTION: DO NOT APPLY MORE THAN THE SPECIFIED TORQUE. IF YOU DO, YOU CAN CAUSE DAMAGE TO THE THREADS OF THE MATING PARTS.

(1) The torques specified in Figure 403 are based on strength of thread in cast aluminum or magnesium. Use these values in stronger materials also.

NOTE: Do not use a lubricant when a sealing compound is specified.

L. Pratt And Whitney Flexible-Type Fittings And Sealastic-Type Fittings
See Figure 404.

CAUTION: DO NOT APPLY MORE THAN THE SPECIFIED TORQUE. IF YOU DO, YOU CAN CAUSE DAMAGE TO THE TUBES.

(1) Install the tube with the flexible fitting to the engine. Refer to the specific AMM maintenance task or to Installation of Tubes With Flexible-Type Fittings (Used With Packings and Retainers) (Task 70-00-00-400-007-004).

(2) Fully install the ferrule, packing, and retainer and align the tube before you apply the torque specified in Figure 404.

(3) After you torque the nut to the specified torque, loosen and torque the nut again.

NOTE: The double torque is done to minimize the loss of torque caused by the compression of the rubber to the mating parts over time.

M. 37 Degree Cone Seat Connectors
See Figure 405 (Sheet 1).

CAUTION: DO NOT APPLY MORE THAN THE SPECIFIED TORQUE. IF YOU DO, YOU CAN CAUSE DAMAGE TO THE TUBES.

(1) Install the 37 degree cone seat tube to the engine. Refer to the specific AMM maintenance task or to Installation of Tubes With Fixed (Brazed) Conical Seat Ferrules (Task 70-00-00-400-007-001).

(2) For 37° conical seat connectors without gaskets, use torque values specified in Figure 405 (Sheet 1).

(3) For 37° cone seat connectors with nickel gaskets (for example, AS3074 and AS3075) or copper gaskets (for example, AS3072 and AS3073), use torque values specified in Figure 405 (Sheet 2).

(4) Do not apply more than the specified torque to correct a leak. Disassemble fitting and check for nicks, burrs, dirt, etc. If necessary, replace the fittings or tubes with different ones.

N. Jamnuts
See Figure 406.

(1) Use the torque values specified in Figure 406 are used for all steel and aluminum jamnuts (locknuts) of the type used on fittings for tube and hose connections.

(2) On elbow fittings, torque the jamnut after you align and connect the tube or hose.

O. Concentric Tube Connectors (Double Wall Tubes)
See Figure 407.

CAUTION: DO NOT APPLY MORE THAN THE SPECIFIED TORQUE. IF YOU DO, YOU CAN CAUSE DAMAGE TO THE TUBES.

(1) Install the double wall tube to the engine as specified in the specific AMM maintenance task. Refer to the specific AMM maintenance task or to Installation of Tubes With Concentric-Type Fittings (Double Wall Tubes) (Task 70-00-00-400-007-005).

(2) Use the antigallant specified in the specific AMM maintenance task.

(3) Use the torque values specified in Figure 407 for the inner and outer tube nuts.

(4) Do not apply more than the specified torque to correct a leak. Disassemble fitting and check for nicks, burrs, dirt, etc. If necessary, replace the fittings or tubes with different ones.

P. Installation and/or Attachment of Various Components of Ignition Systems, Thermocouple Systems, and Electronic Control Systems
See Figure 408.

(1) Plug-In Type Threaded Connectors

(a) Torque as specified by the specific AMM maintenance task.

(b) Do not apply any thread lubricant.

(2) Igniter Plugs

(a) Torque as specified by the specific AMM maintenance task.

(3) Cigarette-Type (Ignition) Electrical Connectors

(a) Torque as specified by the specific AMM maintenance task.

(4) Temperature Probe Nuts

(a) Do not apply any thread lubricant.

(b) Clean the studs with a soft bristle brush before installation of the nuts.

CAUTION: DO NOT APPLY MORE THAN THE SPECIFIED TORQUE. IF YOU DO, YOU CAN CAUSE DAMAGE TO THE TUBES.

(c) Torque terminal attaching nuts (except Klincher nuts) and thermocouple harness-to-lead attaching screws to limits specified in Figure 408.

(5) Exhaust Gas Temperature (EGT) Junction Box

CAUTION: DO NOT APPLY MORE THAN THE SPECIFIED TORQUE. IF YOU DO, YOU CAN CAUSE DAMAGE TO THE TUBES.

(a) Torque harness terminal bus bar attaching nuts (except Klincher nuts) specified in Figure 408.

(6) Klincher Locknuts

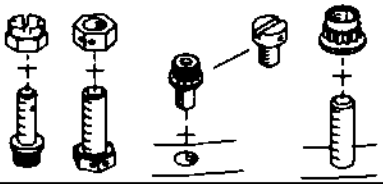
CAUTION: DO NOT APPLY MORE THAN THE SPECIFIED TORQUE. IF YOU DO, YOU CAN CAUSE DAMAGE TO THE TUBES.

(a) Torque free-spinning klincher locknuts to limits specified in Figure 408.

THREAD SIZE (INCH)	TORQUE, lbf-in (Nm)					
	OIL LUBRICATED			ANTI-SEIZE COATED		
	MIN. *		MAX.	MIN. *		MAX.
	TYPE I	TYPE II		TYPE I	TYPE II	
.112 -40	4.5 (0.508)	5 (0.565)	6 (0.678)	3.5 (0.395)	4 (0.452)	4.5 (0.508)
138 -32	8.5 (0.960)	10 (1.130)	11.5 (1.299)	6.5 (0.734)	7.5 (0.847)	8.5 (0.960)
164 -32	16 (1.808)	20 (2.260)	22 (2.486)	12.5 (1.412)	15 (1.695)	16.5 (1.864)
164 -36	18 (2.034)	22 (2.486)	24 (2.712)	13.5 (1.525)	16 (1.808)	18 (2.034)
190 -24	# 23 (2.599)	# 27 (3.051)	30 (3.390)	16(1.808)	19.5 (2.203)	21.5 (2.429)
190 -32	# 24 (2.712)	# 32 (3.616)	36 (4.067)	19.5 (2.203)	# 23 (2.599)	26 (2.938)
.250 -20	# 50 (5.649)	# 65 (7.344)	70 (7.909)	# 37 (4.180)	# 45 (5.084)	50 (5.649)
.250 -28	# 66 (7.344)	# 76 (8.474)	85 (9.604)	# 45 (5.084)	# 54 (6.101)	60 (6.779)
.3125 -18	# 110 (12.428)	# 135 (15.253)	150 (16.948)	# 80 (9.039)	# 95 (10.734)	105 (11.863)
3125 -24	# 125 (14.123)	# 150 (16.948)	170 (19.207)	# 90 (10.169)	# 110 (12.428)	120 (13.558)
.375 -16	# 200 (22.597)	# 250 (28.246)	270 (30.506)	# 140 (15.818)	# 170 (19.207)	185 (20.902)
.375 -24	# 225 (25.422)	# 275 (31.071)	300 (33.895)	# 160 (18.078)	# 190 (21.467)	215 (24.292)
4375 -14	325 (36.720)	375 (42.369)	425 (48.019)	# 225 (25.422)	270 (30.506)	300 (33.895)
4375 -20	350 (39.545)	425 (48.019)	475 (53.668)	255 (28.811)	310 (35.025)	340 (38.415)
.500 -13	500 (56.492)	600 (67.791)	650 (73.440)	340 (38.415)	400 (45.194)	450 (50.843)
.500 -20	550 (62.142)	675 (76.265)	750 (84.739)	380 (44.064)	460 (51.973)	515 (58.187)
5625 -12	700 (79.089)	850 (96.037)	950 (107.336)	500 (56.492)	600 (67.791)	675 (76.265)
5625 -18	800 (90.388)	950 (107.336)	1050 (118.634)	550 (62.142)	675 (76.265)	750 (84.739)
625 -11	1000 (112.985)	1200 (135.582)	1300 (146.880)	675 (76.265)	800 (90.388)	900 (101.686)
.625 -18	1150 (129.933)	1350 (152.529)	1500 (169.477)	775 (87.563)	925 (104.511)	1025 (115.809)
.750 -10	1700 (192.074)	2100 (237.268)	2300 (259.865)	1200 (135.582)	1450 (163.828)	1600 (180.776)
750 -16	2000 (225.970)	2400 (271.164)	2600 (293.760)	1350 (152.529)	1600 (180.776)	1800 (203.373)
875 -9	2800 (316.357)	3400 (384.148)	3700 (418.044)	1950 (220.320)	2350 (265.514)	2600 (293.760)
.875 -14	3200 (361.551)	3800 (429.342)	4200 (474.536)	2200 (248.567)	2600 (293.760)	2900 (327.656)
1.000 -8	4200 (474.536)	5100 (576.222)	5600 (632.715)	2900 (327.656)	3500 (395.447)	3900 (440.641)
1.000 -12	4800 (542.327)	5800 (655.312)	6400 (723.103)	3200 (361.551)	3850 (434.991)	4300 (485.835)
1.125 -7	5900 (666.610)	7200 (813.491)	7900 (892.580)	4100 (463.238)	4900 (553.626)	5400 (610.118)
1.125 -8	6300 (711.804)	7600 (858.664)	8400 (949.072)	4300 (485.835)	5100 (576.222)	5700 (644.013)
1.250 -7	8400 (949.072)	10100 (1141)	11200 (1265)	5800 (655.312)	6900 (779.595)	7700 (869.963)
1.250 -8	8800 (994.266)	10600 (1197)	11700 (1321)	5900 (666.610)	7100 (802.192)	7900 (892.580)
1.375 -6	11000 (1242)	13300 (1502)	14700 (1660)	7600 (858.684)	9100 (1028)	10100 (1141)
1.375 -8	11900 (1344)	14400 (1626)	15900 (1796)	8000 (903.878)	9500 (1073)	10600 (1197)
1.500 -6	14700 (1660)	17700 (1242)	19600 (2214)	10000 (1129)	12000 (1355)	13300 (1502)
1.500 -8	15800 (1785)	19000 (2146)	21100 (2383)	10500 (1186)	12600 (1423)	14000 (1581)
1.750 -5	23200 (2621)	27900 (3152)	30900 (3491)	15800 (1785)	19000 (2146)	21100 (2383)
1.750 -8	25900 (2926)	31100 (3513)	34500 (3897)	17000 (1920)	20400 (2304)	22700 (2564)
2 000 -4.5	35000 (3954)	42000 (4745)	46600 (5265)	23800 (2689)	28500 (3220)	31700 (3581)
2 000 -8	39500 (4462)	47400 (5355)	52600 (5943)	25800 (2915)	31000 (3502)	34400 (3886)

* USE TYPE I MINIMUM VALUES WHERE ALIGNMENT OF LOCKING HOLES (COTTERPINS, SAFETY WIRE, ETC.) IS REQUIRED AT ASSEMBLY. USE TYPE II MINIMUM VALUES WHERE ALIGNMENT OF LOCKING HOLES IS NOT REQUIRED AT ASSEMBLY.

\# FOR SCREWS WITH SCREWDRIVER SLOTS ONLY (NO EXTERNAL WRENCHING PROVISIONS), 22 lbf-in (2.486 Nm) MINIMUM IS PERMITTED.



G-11782 (0803)
PW V

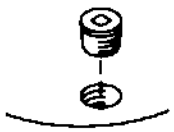
Torques For Free-spinning
Fasteners (Nuts, Bolts, or Screws)
and For Self-locking Nuts on Studs
Figure 401
(Task 70-00-00-400-032)

THREAD SIZE (INCH)	TORQUE, lbf-in (N/m)			
	OIL LUBRICATED		ANTI-SEIZE COATED	
	MIN	MAX.	MIN	MAX.
.112 -40	6 (0.678)	7 (0.791)	5 (0.565)	6 (0.678)
138 -32	12 (1.356)	14 (1.582)	9 (1.017)	11 (1.243)
164 -32	23 (2.599)	26 (2.938)	18 (2.034)	20 (2.260)
164 -36	25 (2.825)	28 (3.164)	20 (2.260)	22 (2.486)
.190 -24	32 (3.616)	35 (3.954)	24 (2.712)	27 (3.051)
190 -32	36 (4.067)	40 (4.519)	27 (3.051)	30 (3.390)
.250 -20	# 74 (8.361)	82 (9.265)	# 55 (6.214)	62 (7.005)
.250 -28	# 85 (9.604)	95 (10.734)	# 62 (7.005)	72 (8.135)
3125 -18	# 160 (18.078)	175 (19.772)	# 115 (12.993)	130 (14.686)
.3125 -24	# 180 (20.337)	200 (22.597)	# 125 (14.123)	140 (15.818)
.375 -16	# 270 (30.506)	300 (33.895)	# 200 (22.597)	220 (24.857)
.375 -24	# 290 (32.766)	325 (36.720)	# 225 (25.422)	250 (28.246)
4375 -14	420 (47.454)	465 (52.538)	315 (35.590)	350 (39.545)
.4375 -20	450 (50.843)	500 (56.492)	340 (38.415)	380 (42.934)
.500 -13	630 (71.180)	700 (79.089)	450 (50.843)	500 (56.492)
.500 -20	720 (81.349)	800 (90.388)	515 (58.187)	575 (64.966)
5625 -12	950 (107.336)	1050 (118.634)	675 (76.265)	750 (84.739)
5625 -18	1050 (118.634)	1150 (129.933)	750 (84.739)	825 (93.212)
.625 -11	1250 (141.231)	1400 (158.179)	900 (101.686)	1000 (112.985)
.625 -18	1450 (163.828)	1600 (180.776)	1030 (116.374)	1150 (129.933)
750 -10	2200 (248.567)	2450 (276.813)	1600 (180.776)	1750 (197.723)
.750 -16	2500 (282.462)	2750 (310.708)	1750 (197.723)	1950 (220.320)
.875 -9	3600 (406.745)	4000 (451.939)	2500 (282.462)	2850 (322.007)
.875 -14	4000 (451.939)	4450 (502.782)	2800 (316.357)	3100 (350.253)
1.000 -8	5400 (610.118)	6000 (677.909)	3800 (429.342)	4200 (474.536)
1.000 -12	6000 (677.909)	6700 (756.998)	4000 (451.939)	4500 (508.432)
1.125 -7	7600 (858.584)	8200 (926.475)	5300 (598.819)	5700 (644.013)
1.125 -8	8000 (903.878)	8700 (982.968)	5600 (632.716)	6000 (677.909)
1.250 -7	10500 (1186)	11600 (1310)	7300 (824.789)	8100 (915.177)
1.250 -8	11000 (1242)	12100 (1367)	7500 (847.386)	8300 (937.774)
1.375 -6	13800 (1559)	15100 (1706)	9600 (1084)	10500 (1186)
1.375 -8	14900 (1683)	16300 (1841)	10000 (1129)	11000 (1242)
1.500 -6	18200 (2056)	20100 (2270)	12500 (1412)	13800 (1559)
1.500 -8	19500 (2203)	21600 (2440)	13100 (1480)	14500 (1638)
1.750 -5	28500 (3220)	31500 (3559)	19600 (2214)	21700 (2451)
1.750 -8	31700 (3581)	35100 (3965)	21000 (2372)	23300 (2632)
2.000 -4.5	42800 (4835)	47400 (5355)	29300 (3310)	32500 (3672)
2.000 -8	48200 (5445)	53400 (6033)	31800 (3592)	35200 (3977)

FOR SCREWS WITH SCREWDRIVER SLOTS ONLY (NO EXTERNAL WRENCHING PROVISIONS), THE MINIMUM PERMITTED TORQUE IS 22 lbf-in (2.486 Nm), PLUS THE TORQUE NECESSARY TO TURN THE SCREW THROUGH THE NUT OR SELF-LOCKING HELICAL COIL INSERT

G-11783 (0603)
PW V

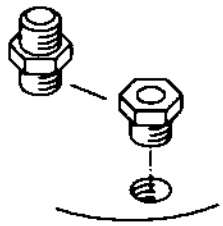
Torques For Self-locking Fasteners (Nuts, Bolts, or Screws), and For Free-running Bolts and Screws Used in Self-locking Helical Coil Inserts
Figure 402
(Task 70-00-00-400-032)



THREAD SIZE (INCH)	TORQUE, lbf-in (Nm)	
	ANPT OR NPT,OIL LUBRICATED *	
	MIN.	MAX.
.062	30 (3.390)	40 (4.519)
.125	30 (3.390)	40 (4.519)
.250	70 (7.909)	85 (9.604)
.375	95 (10.734)	110 (12.428)
.500	140 (15.818)	160 (18.078)
.750	210 (23.727)	230 (25.987)
1.000	285 (32.201)	315 (35.590)
1.250	355 (40.110)	385 (43.499)

* WHERE SEALING COMPOUNDS ARE USED, OMIT OIL LUBRICATION

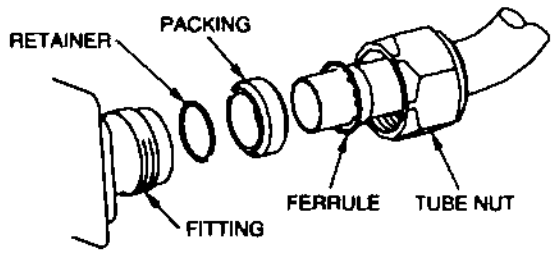
TORQUES FOR STEEL PLUGS IN ALUMINUM AND MAGNESIUM



THREAD SIZE (INCH)	TORQUE, lbf-in (Nm)			
	OIL LUBRICATED		ANTI-SEIZE COATED	
	MIN	MAX.	MIN	MAX.
.250-28	15 (1.695)	20 (2.260)	10 (1.130)	13 (1.469)
.3125-24	35 (3.954)	40 (4.519)	23 (2.599)	26 (2.938)
.375-24	40 (4.519)	50 (5.649)	26 (2.938)	33 (3.728)
.4375-20	65 (7.344)	75 (8.474)	42 (4.745)	49 (5.536)
.500-20	90 (10.169)	100 (11.298)	58 (6.553)	65 (7.344)
.5625-18	110 (12.428)	120 (13.558)	70 (7.909)	80 (9.039)
.625-18	150 (16.948)	170 (19.207)	95 (10.734)	110 (12.428)
.750-16	200 (22.597)	225 (25.422)	130 (14.688)	145 (16.383)
.8125-16	225 (25.422)	250 (28.246)	145 (16.383)	160 (18.078)
.875-14	250 (28.246)	275 (31.071)	160 (18.078)	175 (19.772)
1.000-12	275 (31.071)	300 (33.895)	175 (19.772)	190 (21.467)
1.0625-12	375 (42.369)	425 (48.019)	240 (27.116)	270 (30.506)
1.125-12	415 (46.889)	495 (55.927)	255 (28.811)	300 (33.895)
1.1875-12	450 (50.843)	550 (62.142)	285 (32.201)	350 (39.545)
1.250-12	500 (56.492)	600 (67.791)	315 (35.590)	380 (42.934)
1.3125-12	525 (59.317)	625 (70.616)	330 (37.285)	395 (44.629)
1.500-12	600 (67.791)	700 (79.089)	375 (42.369)	440 (49.713)
1.625-12	650 (73.440)	750 (84.739)	400 (45.194)	470 (53.103)
1.750-12	650 (73.440)	750 (84.739)	400 (45.194)	470 (53.103)
1.875-12	650 (73.440)	750 (84.739)	400 (45.194)	470 (53.103)
2.250-12	650 (73.440)	750 (84.739)	400 (45.194)	470 (53.103)
2.500-12	650 (73.440)	750 (84.739)	400 (45.194)	470 (53.103)

TORQUES FOR HEX-HEAD STRAIGHT THREADED FITTINGS AND PLUGS G-11784 (0802) PW V

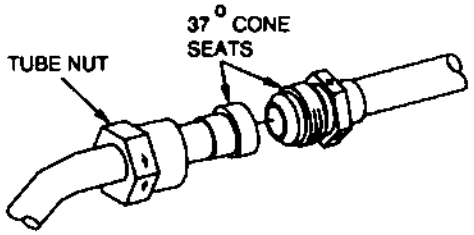
Torques For Steel Pipe Plugs in
Aluminum and Magnesium Cases and
Torques For Hex-Head, Straight
R Threaded Fittings and Plugs
R Figure 403
(Task 70-00-00-400-032)



TUBE DIAMETER (INCH)	THREAD SIZE (INCH)	TORQUE, lbf-in (Nm)			
		FOR 75 DUROMETER A PACKINGS: AMS 7260, 7267, 7273, OR 7276		FOR 77 DUROMETER C (100 DUROMETER A) PACKINGS: PWA-401	
		MIN.	MAX.	MIN.	MAX.
.125	.4375-24	25 (2.825)	30 (3.390)	55 (6.214)	60 (6.779)
.1875	.500-20	25 (2.825)	30 (3.390)	55 (6.214)	60 (6.779)
.250	.625-18	25 (2.825)	30 (3.390)	55 (6.214)	60 (6.779)
.3125	.6875-16	30 (3.390)	35 (3.954)	65 (7.344)	70 (7.909)
.375	.750-16	30 (3.390)	35 (3.954)	65 (7.344)	70 (7.909)
.4375	.8125-16	45 (5.084)	50 (5.649)	90 (10.169)	100 (11.298)
.500	.875-14	55 (6.214)	60 (6.779)	110 (12.428)	120 (13.558)
.5625	1.000-12	60 (6.779)	65 (7.344)	120 (13.558)	130 (14.688)
.625	1.0625-12	65 (7.344)	70 (7.909)	130 (14.688)	140 (15.818)
.750	1.1875-12	70 (7.909)	80 (9.039)	140 (15.818)	160 (18.078)
.875	1.375-12	75 (8.474)	85 (9.604)	150 (16.948)	170 (19.207)
1.000	1.500-12	100 (11.298)	110 (12.428)	200 (22.597)	220 (24.857)
1.125	1.625-12	100 (11.298)	110 (12.428)	200 (22.597)	220 (24.857)
1.250	1.750-12	100 (11.298)	110 (12.428)	200 (22.597)	220 (24.857)
1.500	2.125-12	100 (11.298)	110 (12.428)	200 (22.597)	220 (24.857)

G-11785 (0104)
PW V

Torques For Pratt and
Whitney Flexible Fittings
Figure 404
(Task 70-00-00-400-032)



HOSE SIZE	TUBING OD (INCH)	THREAD SIZE (INCH)	TORQUE, lbf-in (Nm) *					
			ALUMINUM FITTINGS **		STEEL FITTINGS		STEEL FITTINGS	
							TITANIUM FITTINGS ***	
			ALL LUBRICANTS		OIL LUBRICATED		ANTI-SEIZE COATED	
			MIN.	MAX.	MIN	MAX.	MIN.	MAX.
- 3	.1875	.375-24	30 (3.390)	50 (5.649)	70 (7.909)	80 (9.039)	50 (5.649)	60 (6.779)
- 4	.250	.4375-20	40 (4.519)	65 (7.344)	90 (10.169)	100 (11.298)	65 (7.344)	75 (8.474)
- 5	.3125	.500-20	60 (6.779)	80 (9.039)	135 (15.253)	150 (16.948)	100 (11.298)	110 (12.428)
- 6	.375	.5625-18	75 (8.474)	125 (14.123)	270 (30.506)	300 (33.895)	****	****
- -	.4375	.625-18	100 (11.298)	175 (19.772)	320 (36.155)	350 (39.545)	225 (25.422)	250 (28.246)
- -	- -	.6875-24	- -	- -	320 (36.155)	350 (39.545)	225 (25.422)	250 (28.246)
- 8	.500	.750-16	150 (16.948)	250 (28.246)	450 (50.843)	500 (56.492)	340 (38.415)	375 (42.369)
- -	.5625	.8125-16	175 (19.772)	300 (33.895)	550 (62.142)	600 (67.791)	400 (45.194)	450 (50.843)
- 10	.625	.875-14	200 (22.597)	350 (39.545)	650 (73.440)	700 (79.089)	475 (53.668)	525 (59.317)
- -	- -	.875-16	200 (22.597)	350 (39.545)	650 (73.440)	700 (79.089)	475 (53.668)	525 (59.317)
- -	.6875	1.000-12	275 (31.071)	450 (50.843)	800 (90.388)	900 (101.686)	600 (67.791)	675 (76.265)
- -	- -	1.000-14	275 (31.071)	450 (50.843)	800 (90.388)	900 (101.686)	600 (67.791)	675 (76.265)
- 12	.750	1.0625-12	300 (33.895)	500 (56.492)	900 (101.686)	1000 (112.985)	675 (76.265)	750 (84.739)
- -	.875	1.1875-12	400 (45.194)	600 (67.791)	1100 (124.283)	1200 (135.582)	825 (93.212)	900 (101.686)
- -	- -	1.250-12	400 (45.194)	650 (73.440)	1150 (129.933)	1300 (146.880)	900 (101.686)	1000 (112.985)
- 16	1.000	1.3125-12	500 (56.492)	700 (79.089)	1300 (146.880)	1400 (158.179)	950 (107.336)	1050 (118.634)
- -	1.125	1.500-12	600 (67.791)	900 (101.686)	1500 (169.477)	1600 (180.776)	1050 (118.634)	1200 (135.582)
- 20	1.250	1.625-12	600 (67.791)	900 (101.686)	1700 (192.074)	1800 (203.373)	1150 (129.933)	1300 (146.880)
- 24	1.500	1.875-12	600 (67.791)	900 (101.686)	2100 (237.268)	2200 (248.567)	1500 (169.477)	1600 (180.776)

* IF THE NUT OR EITHER OF THE MATING SEALING SURFACES IS ALUMINUM, THE REQUIRED TORQUE LIMITS FOR ALUMINUM FITTINGS APPLY

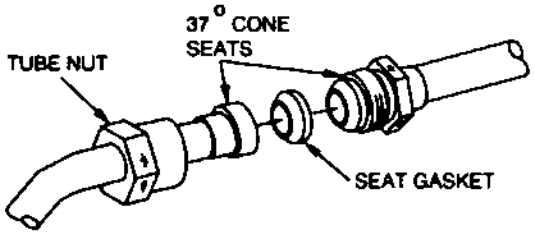
** FOR THRUST REVERSER AIR LINE FITTINGS, USE TORQUES FOR ALUMINUM FITTINGS, REGARDLESS OF MATERIAL, UNLESS OTHERWISE SPECIFIED

*** FOR MIXED MATERIAL ASSEMBLY (STEEL CONNECTOR WITH TITANIUM CONNECTOR WITH STEEL NUT), USE TITANIUM TORQUE

**** FOR STEEL FITTINGS, 200 (22.597) MINIMUM, 225 (25.422) MAXIMUM
FOR TITANIUM FITTINGS, 130 (14.688) MINIMUM, 140 (15.818) MAXIMUM.

G-11786 (0104)
PW V

Torques For 37 Degree Cone Seat
Connectors (Without Gaskets)
Figure 405 (Sheet 1)
(Task 70-00-00-400-032)

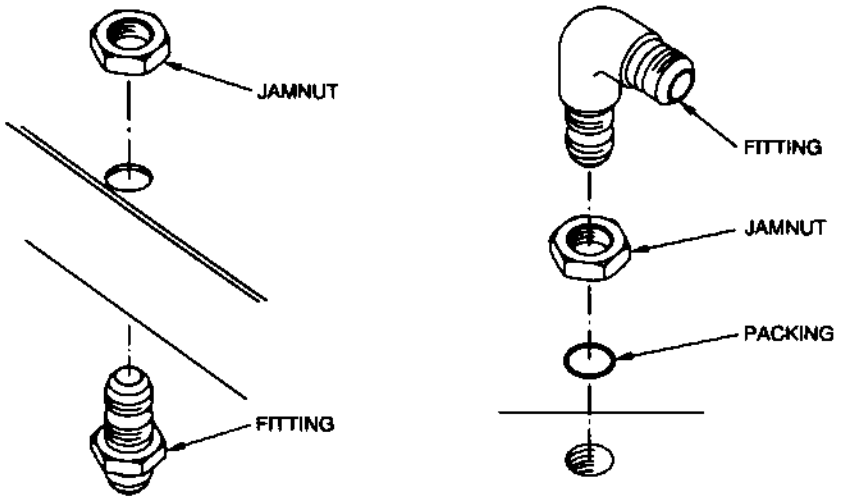


HOSE SIZE	TUBING OD (INCH)	THREAD SIZE (INCH)	TORQUE, lbf-in (Nm)					
			STEEL FITTINGS *				TITANIUM FITTINGS *	
			OIL LUBRICATED		ANTI-SEIZE COATED		ANTI-SEIZE COATED	
			MIN.	MAX.	MIN.	MAX.	MIN.	MAX.
- 3	.1875	.375-24	50 (5.649)	60 (6.779)	40 (4.519)	45 (5.084)	50 (5.649)	60 (6.779)
- 4	.250	.4375-20	90 (10.169)	100 (11.298)	65 (7.344)	75 (8.474)	90 (10.169)	100 (11.298)
- 5	.3125	500-20	135 (15.253)	150 (16.948)	100 (11.298)	110 (12.428)	120 (13.556)	135 (15.235)
- 6	.375	5625-18	200 (22.597)	220 (24.857)	150 (16.948)	165 (18.642)	135 (15.253)	150 (16.948)
- -	.4375	.625-18	250 (28.246)	270 (30.506)	185 (20.902)	200 (22.597)	250 (28.246)	270 (30.506)
- 8	.500	750-16	350 (39.545)	400 (45.194)	270 (30.506)	300 (33.895)	350 (39.545)	400 (45.194)
- -	.5625	8125-16	400 (45.194)	450 (50.843)	300 (33.895)	350 (39.545)	400 (45.194)	450 (50.843)
- 10	.625	.875-14	500 (56.492)	550 (62.142)	360 (40.675)	400 (45.194)	500 (56.492)	550 (62.142)
- -	.6875	1.000-12	600 (67.791)	700 (79.089)	480 (54.233)	530 (59.882)	600 (67.791)	700 (79.089)
- 12	.750	1.0625-12	700 (79.089)	800 (90.388)	540 (61.012)	600 (67.791)	700 (79.089)	800 (90.388)
- -	.875	1.1875-12	800 (90.388)	900 (101.686)	600 (67.791)	675 (76.265)	800 (90.388)	900 (101.686)
- 16	1.000	1.3125-12	1000 (112.985)	1100 (124.283)	750 (84.739)	825 (93.212)	1000 (112.985)	1100 (124.283)
- -	1.125	1.500-12	1300 (146.880)	1400 (158.179)	900 (101.686)	1000 (112.985)	1300 (146.880)	1400 (158.179)
- 20	1.250	1.625-12	1400 (158.179)	1500 (169.477)	1000 (112.985)	1100 (124.283)	1400 (158.179)	1500 (169.477)
- 24	1.500	1.875-12	1600 (180.776)	1700 (192.074)	1200 (135.582)	1300 (146.880)	1600 (180.776)	1700 (192.074)

* FOR MIXED MATERIAL ASSEMBLY (STEEL CONNECTOR WITH TITANIUM NUT OR TITANIUM CONNECTOR WITH STEEL NUT) USE TITANIUM TORQUE

G-11787 (0802)
PW V

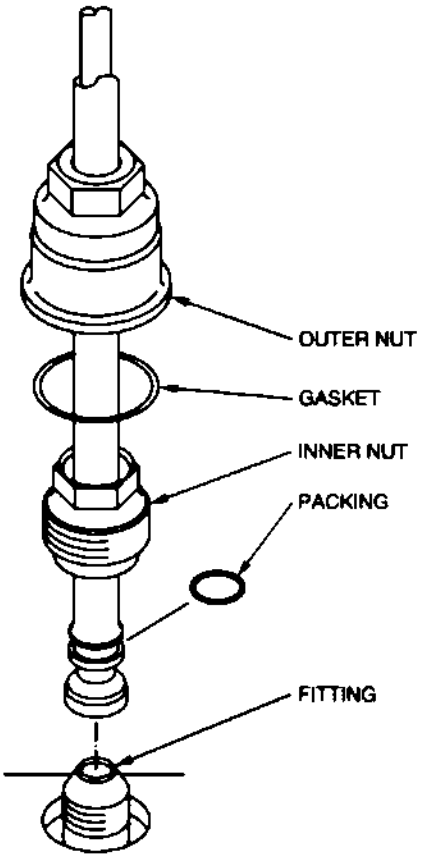
Torques For 37 Degree Cone
Seat Connectors (With
R Nickel or Copper Gaskets)
R Figure 405 (Sheet 2)
(Task 70-00-00-400-032)



THREAD SIZE (INCH)	TORQUE, lbf-in (Nm)	
	MIN	MAX
.250-28	14 (1.582)	16 (1.808)
.3125-24	22 (2.486)	24 (2.712)
.375-24	28 (3.164)	32 (3.616)
.4375-20	38 (4.293)	42 (4.745)
.500-20	58 (6.553)	62 (7.005)
.5625-18	70 (7.909)	80 (9.039)
.625-18	95 (10.734)	105 (11.863)
.750-16	145 (16.383)	155 (17.513)
.8125-16	165 (18.642)	185 (20.902)
.875-14	190 (21.467)	210 (23.727)
1.000-12	260 (29.376)	290 (32.766)
1.0625-12	285 (32.210)	315 (35.590)
1.1875-12	350 (39.545)	390 (44.064)
1.250-12	380 (42.934)	420 (47.454)
1.3125-12	475 (53.668)	525 (59.317)
1.500-12	570 (64.401)	630 (71.180)
1.625-12	570 (64.401)	630 (71.180)
1.875-12	570 (64.401)	630 (71.180)
2.250-12	570 (64.401)	630 (71.180)
2.500-12	570 (64.401)	630 (71.180)

G-00527 (0203)
PW V

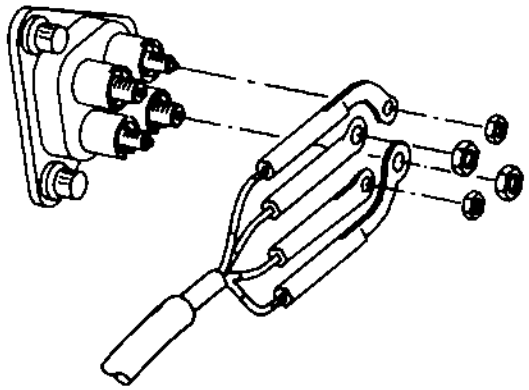
Torques For Jamnuts
Figure 406
(Task 70-00-00-400-032)



INNER NUT			OUTER NUT		
THREAD SIZE (INCH)	TORQUE, lbf-in (Nm)		THREAD SIZE (INCH)	TORQUE, lbf-in (Nm)	
	MIN.	MAX.		MIN	MAX.
.750-16	340 (38.415)	375 (42.369)	1.1875-12	290 (32.766)	340 (38.415)
.8125-16	400 (45.194)	450 (50.843)	1.1875-12	290 (32.766)	340 (38.415)
.9375-12	525 (59.317)	600 (67.791)	1.375-8	370 (41.804)	420 (47.454)
1.750-12	1325 (149.705)	1450 (163.828)	2.375-8	1055 (119.199)	1130 (127.673)

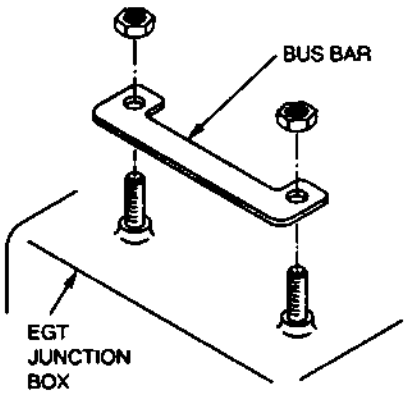
G-11788 (0802)
PW V

Torques For Concentric Tube
Connectors (Double Wall Tubes)
Figure 407
(Task 70-00-00-400-032)



THREAD SIZE (INCH)	TORQUE, lbf-in (Nm)	
	MIN.	MAX.
.138-32	8 (0.904)	10 (1.130)
.164-32	15 (1.695)	18 (2.034)
.190-32	18 (2.034)	22 (2.486)
.216-32	30 (3.390)	35 (3.954)
.250-32	35 (3.954)	40 (4.519)

TORQUES FOR TEMPERATURE PROBE NUTS - NO LUBRICATION



THREAD SIZE (INCH)	TORQUE, lbf-in (Nm)	
	MIN.	MAX.
.164-32	20 (2.260)	25 (2.825)
.190-32	25 (2.825)	30 (3.390)

TORQUES FOR HARNESS TERMINAL AND BUS BAR NUTS - OIL LUBRICATION

THREAD SIZE (INCH)	TORQUE, lbf-in (Nm)	
	MIN	MAX
164-32	15 (1.695)	20 (2.260)
.190-32	24 (2.712)	40 (4.519)

TORQUES FOR KLINCHER NUTS

G-11789 (0802)
PW V

Torques For Nuts on
Electrical Studs
Figure 408
(Task 70-00-00-400-032)

Task 70-00-00-400-040:

1. Installation of Key Washers

A. Effectivity

(1) All (727/8D, 737/8D, Super 27/8D, DC-9/8D)

B. General

(1) This task gives the general instructions for:
- The installation of tab-type key washers.
- The installation of cup-type key washers.

C. References

R (1) Refer to Section 70-11-00 in the Standard Practices
R Manual, PN 585005 for marking parts.

D. Consumable Materials

R (1) (No specific) Marker or Pencil. Refer to Section
R 70-11-00 in the Standard Practices Manual, PN 585005.

E. Procedure - Key Washers (Tab-Type)

(1) Always obey the specific procedures and limits in the specific AMM maintenance tasks.

(2) Some key washers are pre-bent at manufacture.

(3) Use key washers only one time. Use a new key washer for each installation.

(4) Use the correct key washers as specified by the specific AMM maintenance task.

(5) Install key washers as follows. See Figure 401.

(a) Install the key washer so that the unbent keys are as far as possible from the axis of the part to be locked.

(b) The pre-bent key (Key B) must be tight to the overhanging surface as shown, or put against the side of the hole to prevent possible movement of the locked part.

(c) When you torque the fastener and bend the key washer, you must keep the key washer in the same position.

1 If necessary, use a Marker or Pencil, as specified by Marking Parts, to mark the position of the key washer so that you can
R see any movement out of position. Refer
R to Section 70-11-00, General-01 (Task
R 70-11-00-800-001-003) in the Standard Practices
R Manual, PN 585005.

(d) Hold the key washer against the antirotation surface in the loosen direction while you torque the fastener to the torque specified by the Engine Manual.

(e) Examine the pre-bent key (Key B) to make sure that it is not damaged.

(f) For pre-bent keys (Key B) that use a surface edge for antirotation, make sure that the gap between the key (Key B) and the surface is 0.020 inch (0.508 mm) or less.

1 You can bend the pre-bent key (Key B) at installation to meet the gap limits.

(g) Carefully bend all keys (Keys A) on the key washer so that it cannot be used again and that you do not cause cracks, gouges, or other damage.

(h) Bend at least one key (Key A) so that 75 percent or more of its width (as measured at the base of the key) engages the flat of the fastener (Dimension A).

(i) Bend all the keys (Keys A) so that the gap is within the limits which follow.

1 For fastener threads 0.3125 inch (7.938 mm) or less, Gap A is 0.010 inch (0.254 mm) or less.

2 For fastener threads more than 0.3125 inch (7.938 mm), Gap A is 0.020 inch (0.508 mm) or less.

(6) Install elliptical key washers as follows.

(a) After you torque the fasteners, bend the washer up across one whole face of the hexagon.

1 For fastener threads 0.3125 inch (7.938 mm) or less, Gap A is 0.010 inch (0.254 mm) or less.

2 For fastener threads more than 0.3125 inch (7.938 mm), Gap A is 0.020 inch (0.508 mm) or less.

(7) The previous requirements for key washers and elliptical key washers are applicable to the keys for each hole in a multiple-hole key washer.

(8) Key washers used with fuel nozzle nuts must not have the keys bent by impact.

(9) Examine the installed key washer as follows.

(a) Make sure that a new key washer was installed.

(b) Make sure that the keys are bent as previously specified.

(c) Make sure that the keys are bent so that the key washer and fastener cannot move or turn to loosen.

(d) Scoring, gouging, and smearing of the key washer or adjacent parts are not permitted.

(e) Small tool marks from usual forming and bending procedures are permitted.

F. Procedure - Key Washers (Cup-Type)
See Figure 402.

(1) Always obey the specific procedures and limits in the specific AMM maintenance tasks.

(2) Some key washers are pre-bent at manufacture.

(3) Use key washers only one time. Use a new key washer for each installation.

(4) Use the correct key washers as specified by the specific AMM maintenance task.

(5) Crimping Tools

R
R

(a) Tool Requirements

1 The portion of the tool that forms the indentations must be spherically shaped and have a spherical radius of not less than 0.050 inch (1.270 mm).

(b) Squeeze Action Tool

1 This tool forms indentations by pressing the cup-type key washer into slots in the nut or bolt. This type of tool is recommended and must be used where possible.

(c) Drift Type Tool

1 This tool consists of a ring with prongs on the inside diameter. This tool, when put over the cup-type key washer and moved in an axial direction, will form indentations on the outside diameter of the cup-type key washer.

(d) Punch

CAUTION: CUP-TYPE KEY WASHERS USED WITH FUEL NOZZLE NUTS MUST NOT HAVE THE INDENTATIONS FORMED BY IMPACT. IF YOU DO NOT OBEY THIS CAUTION, DAMAGE TO THE FUEL NOZZLE CAN OCCUR.

1 This tool will form indentations on the outside diameter of the cup-type key washer by the impact of the tool with a hammer.

(6) Position Control To Prevent Broken Or Bent Tabs

CAUTION: USE THE CORRECT MARKING PEN OR PENCIL. IF YOU DO NOT, THE MARK CAN HAVE A HARMFUL EFFECT ON THE MATERIALS.

(a) To prevent broken or bent key washer tabs, you must mark the position of the cup-type key washer to the adjacent surface before you tighten and torque the nut.

R
R

(b) Use an approved Marker or Pencil as specified in
R Marking Parts. Reference Section 70-11-00,
R General-01 (Task 70-11-00-800-001-003) in the
R Standard Practices Manual, PN 585005. Mark the parts so that you can detect any turn of the key washer during the torque of the nut.

(7) Required Number Of Indentations

(a) For cup-type key washers, you must bend the key washer in two or more places to give sufficient interference with the nut so that the nut will not turn. Refer to Figure 402 (Sheet 1) and (Sheet 2) for requirements.

(b) After you tighten and torque the nut, you must indent the cup-type key washer in the correct number of places. Refer to Table 401 unless specified differently.

(c) If the number of rounded slots in the nut or bolt is less than the necessary amount of indentations, the requirements of Table 401 do not apply.

(d) If the key washer is the type shown in Figure 402 (Sheet 2), the requirements of Table 401 do not apply.

Thread Size	Number of Indentations	Spacing Between Identations
Less Than 1.500 Inch (38.100 mm)	2	See Figure 402 (Sht 1)
1.500 Inch (38.100 mm) To Less Than 2.500 Inch (63.500 mm)	4	60° - 120°
2.500 Inch (63.500 mm) To Less Than 4.000 Inch (101.600 mm)	6	6 Slot Nut 45° - 75°
	6	8 Slot Nut 45° - 90°*
4.000 Inch (101.600 mm) And Larger	8	30° - 60°

* See Figure 402 (Sheet 1) for indentation spacing.

Required Number Of Indentions
Table 401

(e) For the cup-type key washers shown in Figure 402 (Sheet 1) and (Sheet 2), you must make the indentations as shown.

(8) Key Washer Engagement

Thread Size	B Reference	C Minimum * Engagement
0.190 Inch (4.826 mm)	0.043 Inch (1.092 mm)	0.026 Inch (0.660 mm)
0.250 Inch (6.350 mm)	0.042 Inch (1.067 mm)	0.025 Inch (0.635 mm)
0.3125 Inch (7.938 mm)	0.040 Inch (1.016 mm)	0.024 Inch (0.610 mm)
0.375 Inch (9.525 mm)	0.039 Inch (0.991 mm)	0.023 Inch (0.584 mm)

*C Minimum = 0.6 B

Required Engagement Measurements
For Cup-type Key Washers
Table 402

(9) Examine the installed key washer as follows.

(a) Make sure that a new key washer was installed.

(b) Make sure the key washer is not loose and cannot shake or rattle.

(c) Make sure the cup is bent as previously specified.

(d) Make sure the key washer did not move during the assembly.

(e) If there is no axial pinch on the diaphragm portion of the key washer, you can move the washer by hand through the limits of the tab clearance.

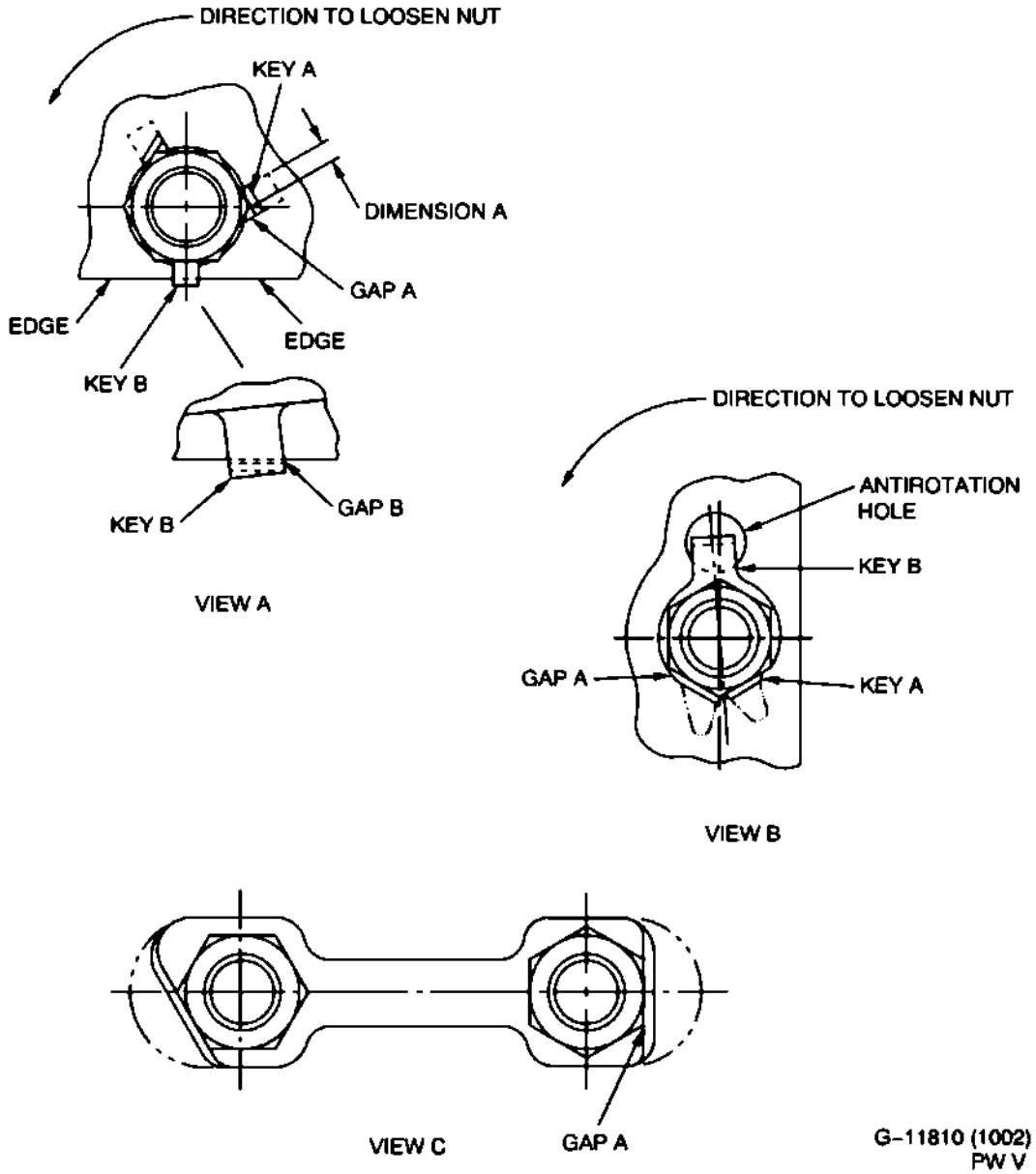
(f) Cracking, tearing, scoring, gouging, and smearing of the key washer or adjacent parts are not permitted.

(g) Small tool marks from usual forming and bending procedures are permitted.

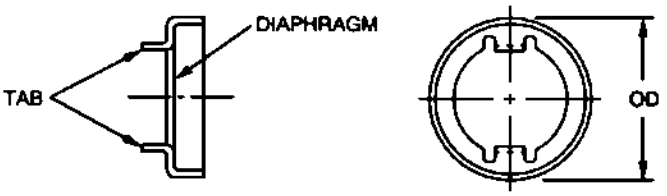
(h) Indentations in one key washer must be of similar size and shape.

R
R

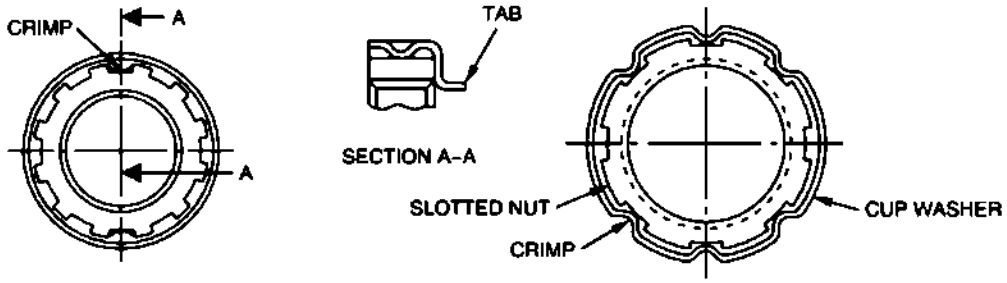
(i) Indentations in the key washer must be formed into the rounded slots in the nut where the nut has such slots.



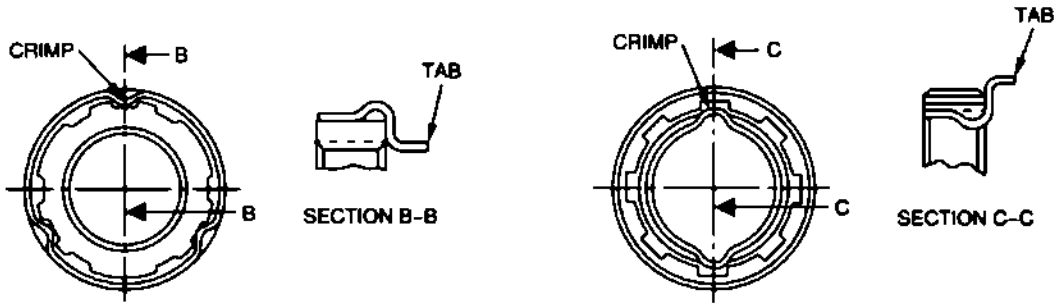
Installation of Key Washers (Tab-Type)
Figure 401
(Task 70-00-00-400-040)



TYPICAL CUT-TYPE
KEYWASHER



CRIMPING

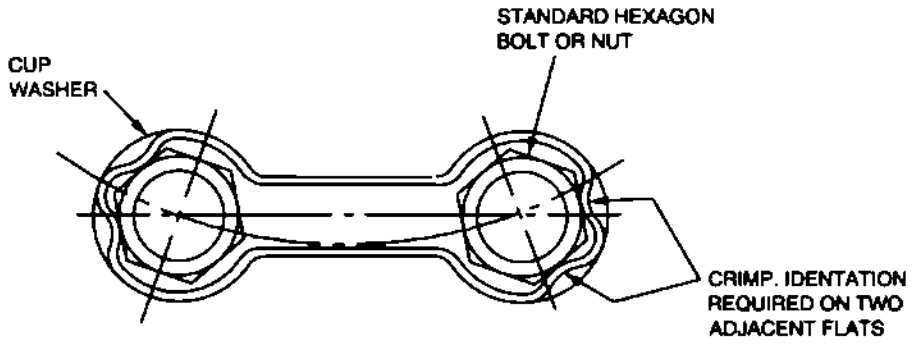


EXTERNAL CRIMP

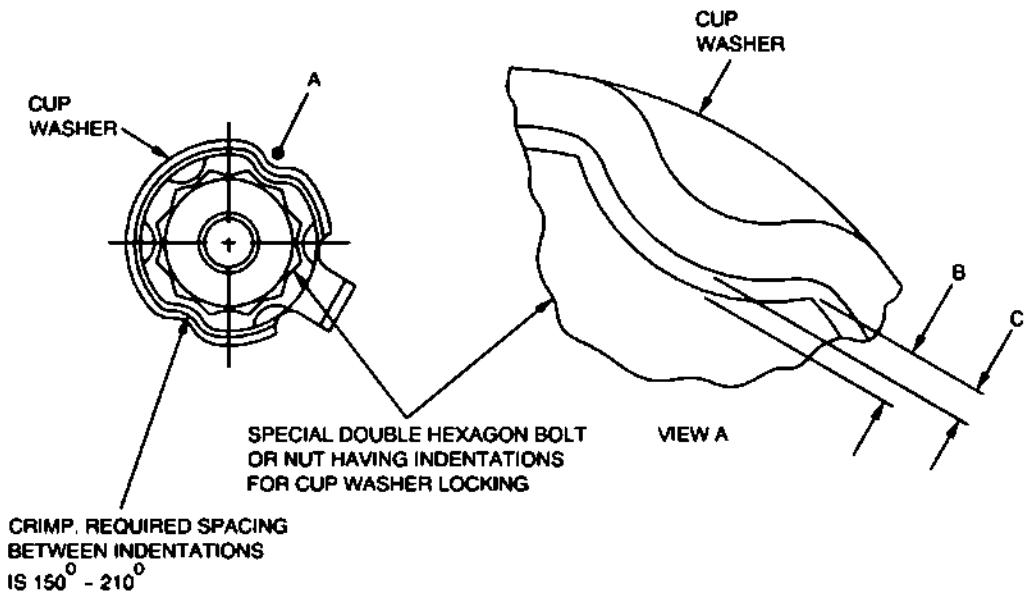
INTERNAL CRIMP

G-11808 (1002)
PW V

Installation of Key
Washers (Cup-Type)
Figure 402 (Sheet 1)
(Task 70-00-00-400-040)



MULTI-HOLE CUP-TYPE CRIMP



SINGLE TAB CUP-TYPE
DIMPLE ENGAGEMENT

G-11809 (1002)
PW V

Task 70-00-00-400-041:

1. Installation of Cotter Pins

A. Effectivity

(1) All (727/8D, 737/8D, Super 27/8D, DC-9/8D)

B. General

(1) This task gives the general instructions for the correct installation of cotter pins.

C. Procedure - General Instructions

(1) Always obey the specific procedures and limits in the specific AMM maintenance tasks.

(2) Use cotter pins only one time. Use a new cotter pin for each installation.

(3) Use the correct cotter pin as specified by the AMM maintenance task.

D. Procedure

(1) Install a cotter pin to safety a nut as follows. See Figure 401.

(a) Torque the fastener to the minimum torque limit as specified by the Engine Manual.

(b) If the cotter pin hole does not align with the slot, continue to torque the fastener to the maximum torque as specified by the Engine Manual but only enough for alignment.

(c) If you cannot get the alignment with the fastener torqued within the specified limits, replace the fastener with a different one.

(d) Continue to torque the fastener to the torque specified by the Engine Manual for alignment.

(e) Make sure more than 50 percent of the pin hole is below the top edge of the nut. See View A.

(f) Install the cotter pin as follows.

1 Install and align the cotter pin so that you can bend the prongs up and over the bolt and down over the nut.

2 While you hold the head tight to the hole, bend the prongs so that the upper prong is tight on the end of the bolt and the bottom prong is tight on the side of the nut.

a Do not bend the cotter pin head.

3 If necessary, cut off the end of the upper prong to be level with the end of the bolt.

4 If necessary, cut off the end of the lower prong for a tight fit on the nut.

(2) Install a cotter pin to safety a pin, rod, or collar as follows. See Figure 401.

(a) Install the cotter pin as follows.

1 Install and align the cotter pin so that you can bend the prongs around the outside diameter of the pin, rod, or collar.

2 While you hold the head tight to the hole, bend the prongs against the outside diameter of the pin, rod, or collar.

a Do not bend the cotter pin head.

3 If necessary, cut off the end of the prongs to get the correct length.

(3) Examine the installed cotter pin as follows.

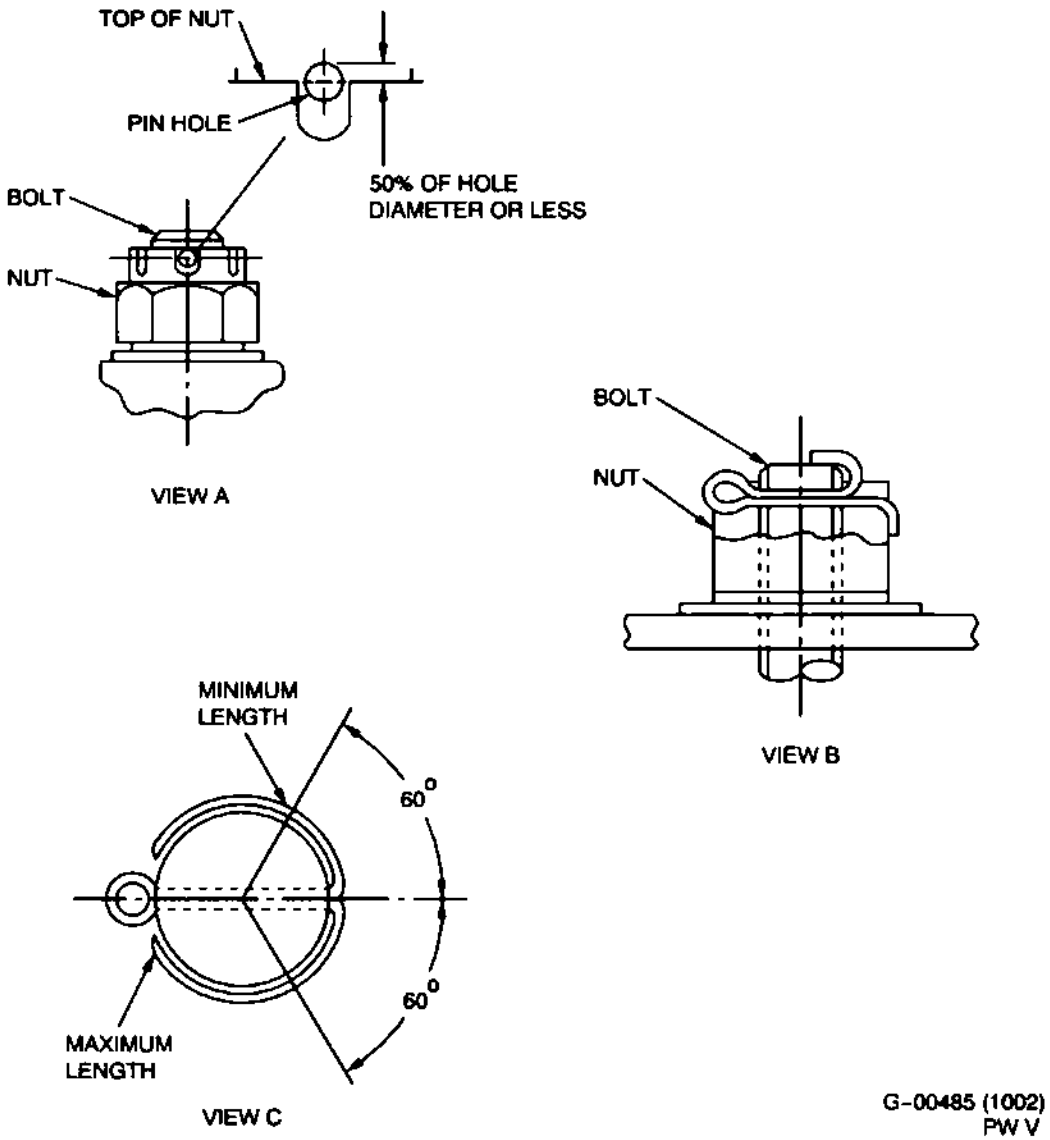
(a) Make sure that a new cotter pin was installed.

(b) Make sure that the prongs are bent as previously specified.

(c) Make sure that the prongs are bent so that the cotter pin and fastener cannot move or turn to loosen.

(d) Scoring, gouging, and smearing of the cotter pin or adjacent parts are not permitted.

(e) Small tool marks from usual forming and bending procedures are permitted.



Installation Of Cotter Pins
Figure 401
(Task 70-00-00-400-041)

Task 70-00-00-400-042:

1. Installation of Retaining Rings

A. Effectivity

(1) All (727/8D, 737/8D, Super 27/8D, DC-9/8D)

B. General

(1) This task gives the general instructions for the correct installation of retaining rings.

C. Procedure - General Instructions

(1) Always obey the specific procedures and limits in the specific AMM maintenance tasks.

(2) Retaining rings must be installed with approved retaining ring pliers.

(a) Internal-type rings must not be compressed beyond the point where the ends of the rings meet.

(b) External-type rings must be expanded only enough to permit installation without becoming bent.

(3) After installation, make sure each retaining ring is fully seated, without looseness or distortion, in its groove.

(4) Distorted retaining rings must be replaced.

D. Procedure - Plain Retaining Rings

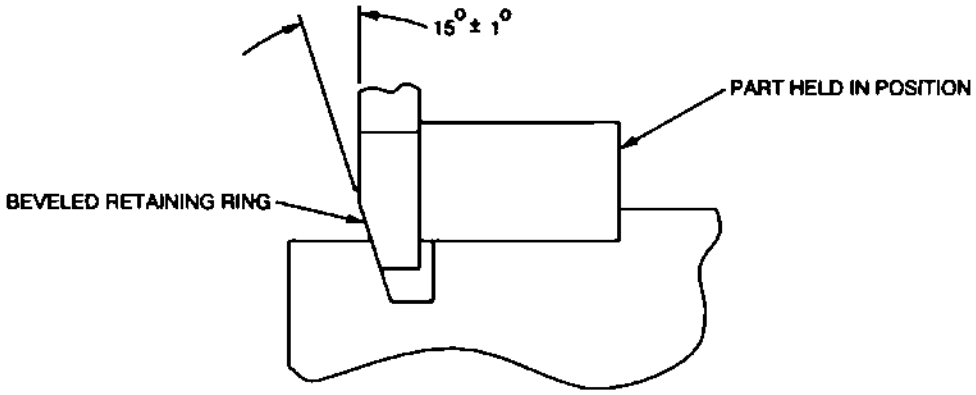
(1) Plain retaining rings can contain slightly rounded edges on one side and sharp edges on the opposite side. The slight rounding, caused by the stamping die, is not a bevel, and the ring must not be classified a beveled ring.

(2) Plain retaining rings must be installed only in square sided grooves. When one side of a plain ring has visibly sharper corners, this side must be installed away from the detail part being retained, so that the sharp-edged side thrusts against the groove.

E. Procedure - Beveled Retaining Rings

(1) Beveled retaining rings have the added function of taking up end play in the detail part being retained. This type ring has a definite 15° bevel on one side designed to fit a corresponding bevel on the side of the groove away from the part being retained.

(2) Beveled retaining rings should be used only in correspondingly beveled grooves. These rings should be installed with the flat side of the ring toward the detail part being retained. See Figure 401.



G-00481 (0802)
PW V

Installation of Retaining Rings
Figure 401
(Task 70-00-00-400-042)

Task 70-00-00-400-043:

1. Installation of Safety Wire

NOTE: The nomenclatures lockwire and safety wire are interchangeable.

A. Effectivity

(1) All (727/8D, 737/8D, Super 27/8D, DC-9/8D)

B. General

R (1) The instructions that follow fully satisfy PWA 316
R Safety Wire (Lockwire) Installation instruction
R procedures for fasteners, which include:

R (a) Bolts, Screws, Nuts

R (b) Tube Coupling Nuts, Hose Connectors, Jamnuts

R (c) Electrical Connectors

R (d) Lead Seals.

C. References

(1) Standard Torques, Removal/Installation-32, (Task 70-00-00-400-032).

D. Equipment

(1) (No specific) Safety Pliers or Twisters

E. Consumable Materials

(1) (No specific) Safety Wire, as specified by the specific AMM maintenance task)

F. Procedure - General Specifications

(1) Always obey the specific procedures and limits in the specific AMM maintenance tasks.

R (2) The term safety wire and lockwire are interchangeable.
R Safety wire is the newer term. Thus, the remaining
R text will use the newer term.

R (3) In commercial engine assembly procedures, P & W used
R different types of safety wire over the years.

R (a) MS9226 (AMS 5687) and MS20995N (NASM20995) safety
R wires are Inconel 600 nickel safety wires, which
R are stiff and difficult to work with.

R (b) AS3214 (AMS 5689, AISI 321) safety wire is a
R stabilized stainless steel safety wire that is
R not as stiff as the Inconel 600 wires and thus is
R easier to work with.

R (c) MS20995C (NASM20995) and AMS 5697 are 304-series
R stainless steel safety wires that are used in
R applications where the temperatures are less than
R 700°F (371°C).

R (4) Use the correct safety wire as specified in the specific AMM maintenance task.

R (5) Obey the maximum safety wire length limits which follow.

(a) The maximum length (span) of safety wire between two tension points is 6 inches (152.4 mm) maximum, unless specified differently by the specific AMM maintenance task.

(b) The maximum length of safety wire used to safety multiple fasteners together in a series (3 or 4) is 24 inches (609.6 mm) maximum, unless specified differently by the specific AMM maintenance task.

R (6) Obey the maximum number of fasteners in a series limits which follow.

(a) Do not safety more than four fasteners in a series with one continuous length of wire, unless specified differently by the specific AMM maintenance task.

(b) If there are more than four fasteners in a series and the text or illustration specifies "Safety Wire Together", do the steps which follow.

1 Divide this group into smaller groups of two, three, or four fasteners.

2 Safety each of the smaller groups separately with safety wire.

3 Safety the smaller groups in series with each other with safety wire.

G. Procedure

(1) Torque the parts before you install the safety wire as follows. See Figure 401.

(a) All fasteners must be correctly torqued before you install the safety wire.

(b) For two or more fasteners safetied together, you must also put the wire holes in a correct position in relation to each other.

(c) To get the correct hole alignment, torque the fasteners to the limits for fasteners with wire holes. Refer to the specific AMM maintenance task or the Standard Torques (AMM TASK 70-00-00-400-032).

(d) Do not decrease the torque less than the specified limit to correctly align the wire holes.

(e) Do not increase the torque more than the specified limit to correctly align the wire holes.

(f) If necessary, use another fastener or part to correctly align the wire holes within the specified torque limits.

(2) Select the number of strands of the safety wire as follows.

(a) Use two strands of safety wire twisted together (double-twisted), unless specified differently by the specific AMM maintenance task.

(b) Use a single strand safety wire only where specified by the specific AMM maintenance task.

(3) Examine the safety wire holes as follows.

CAUTION: DO NOT INSTALL THE SAFETY WIRE IN HOLES WITH BURRS OR SHARP EDGES. IF YOU DO, THE SAFETY WIRE CAN BREAK DURING ENGINE OPERATION.

(a) Examine the safety wire holes for burrs or sharp edges.

(b) Remove the burrs or sharp edges from the safety wire holes.

(c) If necessary replace the parts with burrs or sharp safety wire holes.

(4) Examine the safety wire pliers as follows.

(a) Examine the jaws of the safety wire pliers for sharp edges or corners.

(b) If necessary, round off the sharp pliers jaws and make smooth.

NOTE: This will prevent nicks and damage to the safety wire.

(5) Determine the direction and pattern of the safety wire for the parts that must be safetied. See Figure 402 for examples.

NOTE: Figure 402 does not show every possible combination of parts that can be safety wired. Use these figures as a guide for other applications.

(a) Install safety wire for a group of three bolts or screws as shown in Examples 3 through 6.

(b) Install safety wire for a group of two bolts or nuts with the wire wrapped over the top of a bolt or nut as shown in Examples 7 and 8.

1 Use this method if there is little or no clearance around the bolt or nut.

(c) Install safety wire for a square plug to a lug with a safety wire hole as shown in Example 9.

(d) Install safety wire for a single screw to a lug with a safety wire hole as shown in Example 10.

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(e) Install safety wire for two bolts that are on a different plane as shown in Example 11.

(f) Install safety wire for hollow head plugs as shown in Examples 12 through 14.

(g) Install a single strand of safety wire for multiple screws as shown in Example 15.

(h) Install safety wire wrapped around an adjacent bracket for a bolt as shown in Examples 16.

1 Use this method to safety any part if there is no lug with a safety wire hole.

(i) Install safety wire for tube and hose nuts or electrical connectors as shown in Example 17 and 18.

(j) Install safety wire for tube and hose nuts or electrical connectors with a lug with a safety wire hole as shown in Example 19 and 20.

(k) Install safety wire for tube and hose nuts or electrical connectors without a lug with a safety wire hole as shown in Example 21 and 22.

(l) Install safety wire for small tube nuts or nuts made of soft material as shown in Example 23.

1 Use this method for all nuts with a thin wall thickness at the safety wire holes.

2 Wrap the wire around the nut as shown to prevent a break through the thin wall section.

(m) Install safety wire for two adjacent tube and hose nuts or electrical connectors as shown in Example 24.

(n) Install safety wire for tube and hose nuts or electrical connectors to a lug with a safety wire hole as shown in Example 25.

(o) Install safety wire for a tube nuts on a tee as shown in Example 26.

(p) Install safety wire for a straight bulkhead tube nut to a bolt as shown in Example 27.

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R

(q) Install safety wire for a tube nuts and jam nuts as shown in Examples 28 through 30.

(r) Install a lead seal to the end of the safety wire as shown in Examples 31 and 32.

1 Attach the seal at the end of the safety wire after the last item is safetied.

2 Wrap the loose end of the wire to the safety wire in front of the seal or to an empty safety wire hole.

(6) Install the safety wire as follows. See Figure 401.

(a) Install the safety wire so that it always applies tension to tighten the parts.

(b) Make sure that there is no additional tension on the wire other than the original tension.

(c) If the torque on the threaded part becomes reduced, do the steps which follow.

1 Remove the safety wire.

2 Tighten the fastener again to the specified torque limits.

3 Install the safety wire again.

(d) Obey all the assembly instructions if any slack is necessary between tension points.

(e) Pull the safety wire tight as you twist it and make the recommended number of twists. Refer to Table 401.

Wire Diameter Inch (mm)	Twists/Inch (25.4 mm)
0.015 - 0.017 Inch (0.381 - 0.432 mm)	11 - 14
0.019 - 0.021 Inch (0.483 - 0.533 mm)	9 - 13
0.024 - 0.026 Inch (0.610 - 0.660 mm)	9 - 12
0.030 - 0.034 Inch (0.762 - 0.864 mm)	7 - 10
0.038 - 0.042 Inch (0.965 - 0.067 mm)	7 - 10
0.049 - 0.053 Inch (1.245 - 1.346 mm)	5 - 8
0.061 - 0.065 Inch (1.549 - 1.651 mm)	5 - 8

R
R Recommended Safety Wire Twists
Table 401

Wire Diameter Inch (mm)	Twists/Inch (25.4 mm)

(CONTINUED)

NOTE: One twist is a twist of the wires through an arc of 180 degrees, equal to half of a complete turn.

Recommended Safety Wire Twists
Table 401 (Continued)

(f) Twist the wire to one-eighth inch (3.175 mm) distance from the safety wire hole.

(7) Trim off the unwanted safety wire as follows.

CAUTION: BE SURE THAT THE CUT WIRE ENDS DO NOT FALL INTO THE ENGINE. IF THEY DO, THE SAFETY WIRE CAN CAUSE DAMAGE DURING ENGINE OPERATION.

(a) Cut off the unwanted wire at the end of the last fastener and keep at least three full twists.

1 Do not twist off the end of the safety wire with the wire twist pliers.

2 You must use wire cutting pliers to cut off the end of the wire.

(b) Make sure that the safety wire does not have loose or non-twisted ends.

(c) Make sure that the safety wire does not have sharp ends.

(d) Bend the end of the wire in towards the part so that it does not point out.

NOTE: If the ends point out they could be a safety hazard to persons who work on the engine. They could also vibrate in the airstream during engine operation and break off.

(8) Examine the safety wire after installation as follows.

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R

(a) Examine the safety wire for flex limits as follows.

1 Push on the safety wire at mid-span with light finger pressure, approximately 2 lbs (0.91 kg).

2 The total flex for the safety wire must not be more than the limits shown in Figure 403.

(b) Examine the safety wire for damage as follows.

CAUTION: BE SURE THAT THERE ARE NO CRACKS IN THE WIRE. IF THERE ARE, THE SAFETY WIRE CAN BREAK AND CAUSE DAMAGE DURING ENGINE OPERATION.

1 Examine the wire for cracks or broken strands. Cracks or broken strands are not permitted.

2 Examine the wire for nicks, kinks or damage. Nicks, kinks or damage are not permitted.

3 Remove and replace the safety wire if you find any cracks, broken strands, nicks, kinks or damage.

4 Examine the safety wire for abrasions. Light abrasions from the safety wire pliers are permitted.

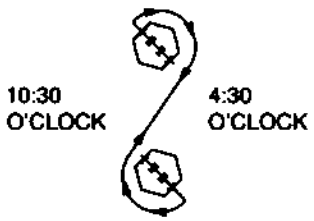
(c) Examine the safety wire for clearance as follows.

1 Examine the safety wire for clearance between all adjacent parts.

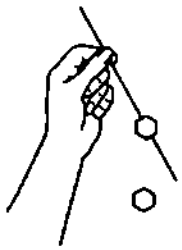
2 The wire must not touch, chafe or rub on adjacent parts during engine operation.

3 The wire must not stretch or get too much tension during engine operation.

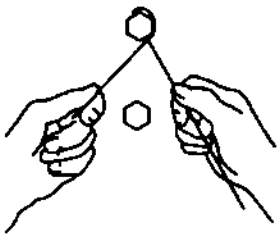
4 The above limits apply for all parts that move during engine operation, (examples are variable stator rings, bleed valves, actuators, control cables, and linkage).



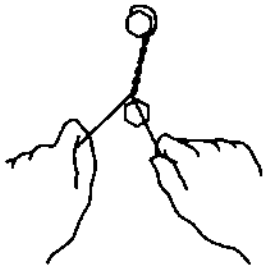
STEP 1
ALIGN THE SAFETY WIRE HOLES.



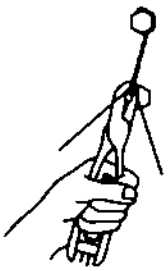
STEP 2
INSTALL THE CORRECT GAGE SAFETY WIRE.



STEP 3
BEND THE SAFETY WIRE AROUND THE BOLT HEAD



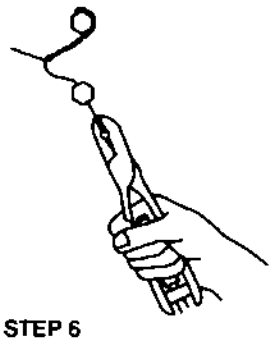
STEP 4
TWIST THE SAFETY WIRE UNTIL SAFETY WIRE IS JUST SHORT OF THE HOLE IN THE SECOND BOLT.



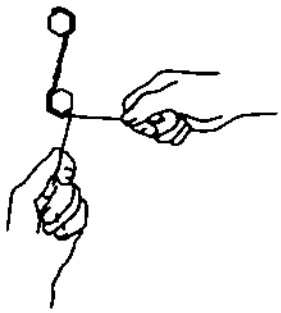
STEP 5
KEEP THE SAFETY WIRE UNDER TENSION AND TWIST IT IN A CLOCKWISE DIRECTION UNTIL THE SAFETY WIRE IS TIGHT.

G-11777 (0802)
PW V

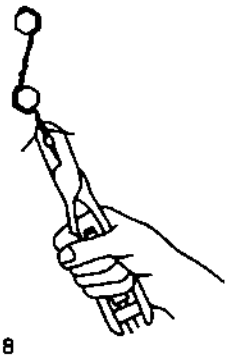
Installation of Safety Wire
Figure 401 (Sheet 1)
(Task 70-00-00-400-043)



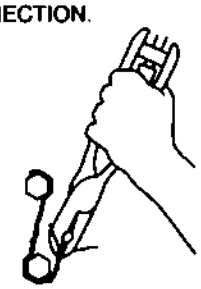
STEP 6
PUT THE UPPERMOST WIRE THROUGH THE SAFETY WIRE HOLE IN THE SECOND BOLT PULL THE WIRE TIGHT WITH PLIERS.



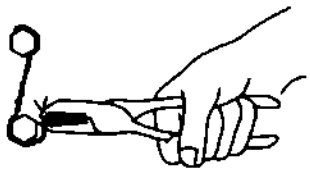
STEP 7
BRING THE FREE END OF THE WIRE AROUND THE BOLT HEAD IN A COUNTERCLOCKWISE DIRECTION. TWIST THE TWO ENDS OF THE SAFETY WIRE IN A COUNTERCLOCKWISE DIRECTION.



STEP 8
GRASP THE SAFETY WIRE BEYOND THE TWISTED PORTION AND TWIST THE SAFETY WIRE ENDS COUNTERCLOCKWISE UNTIL TIGHT.



STEP 9
DURING THE FINAL TWISTING MOTION OF THE PLIERS, BEND THE SAFETY WIRE DOWN AND UNDER THE HEAD OF THE BOLT.

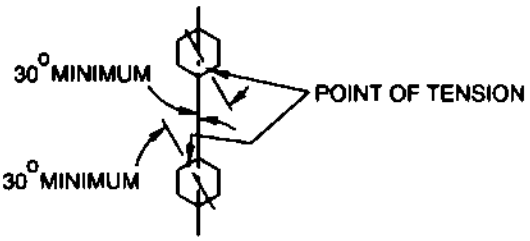


STEP 10
CUT OFF EXCESS SAFETY WIRE WITH DIAGONAL CUTTERS.

G-11778 (0802)
PW V

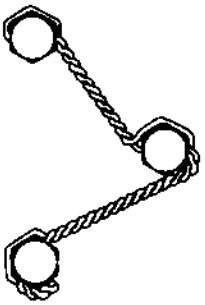
Installation Of Safety Wire
Figure 401 (Sheet 2)
(Task 70-00-00-400-043)

EXAMPLE 1

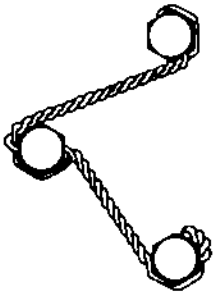


EXAMPLE 2

EXAMPLE 3



EXAMPLE 4



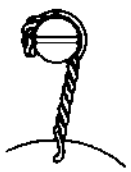
EXAMPLE 5

EXAMPLE 6

EXAMPLE 7

EXAMPLE 8

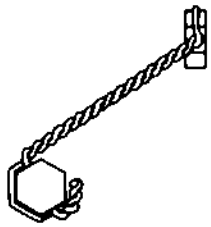
EXAMPLE 9



EXAMPLE 10

G-00499 (0802)
PW V

Installation of Safety
Wire (Examples)
Figure 402 (Sheet 1)
(Task 70-00-00-400-043)



EXAMPLE 11
SAFETY WIRE OF BOLTS
THAT ARE IN DIFFERENT PLANES.

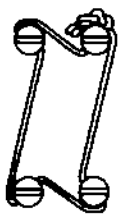
EXAMPLE 12

EXAMPLE 13

EXAMPLE 14

SAFETY WIRE OF HOLLOW HEAD PLUGS

EXAMPLE 12 IS THE RECOMMENDED
METHOD. EXAMPLES 13 AND 14 ARE
SATISFACTORY ALTERNATIVE METHODS.



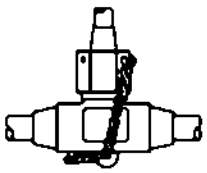
EXAMPLE 15
SAFETY WIRE METHOD WITH A SINGLE WIRE
FOR A CLOSELY SPACED MULTIPLE GROUP.

G-00500 (0802)
PW V

EXAMPLE 16

EXAMPLE 17

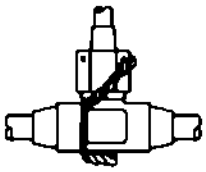
EXAMPLE 18



EXAMPLE 19

EXAMPLE 20

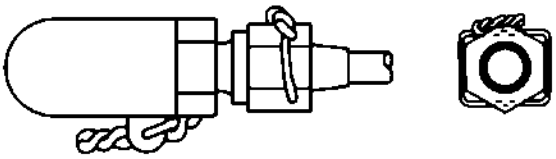
SAFETY WIRE METHOD FOR FITTINGS
WITH SAFETY WIRE LUG.



EXAMPLE 21

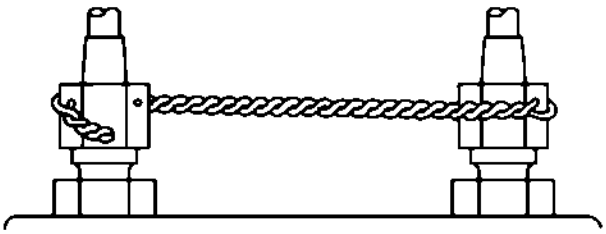
EXAMPLE 22

SAFETY WIRE METHOD FOR FITTINGS
WITHOUT SAFETY WIRE LUG.

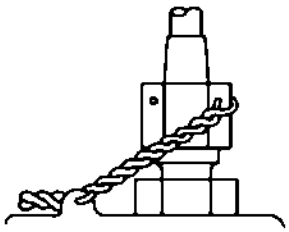


EXAMPLE 23
SAFETY WIRE METHOD FOR SMALL TUBE NUTS
WITH THIN WALL THICKNESS

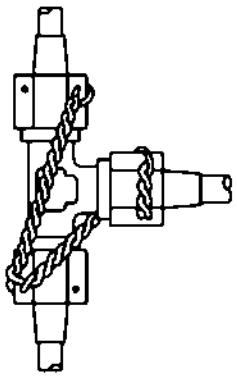
G-00501 (0802)
PW V



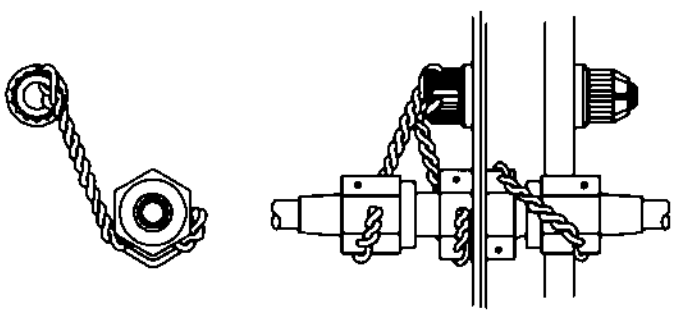
EXAMPLE 24



EXAMPLE 25

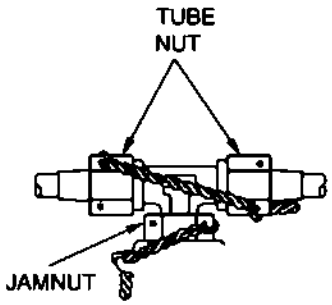


EXAMPLE 26

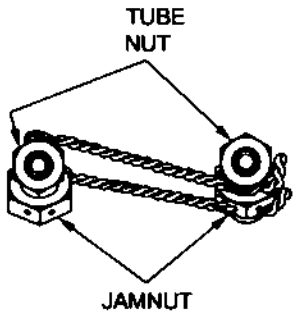


EXAMPLE 27
STRAIGHT CONNECTOR
(BULKHEAD-TYPE)

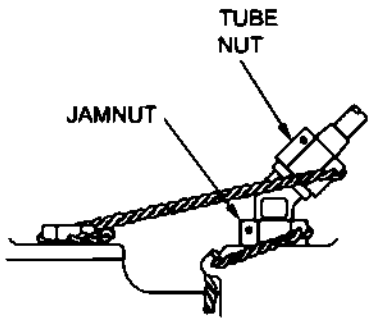
G-01001 (0802)
PW V



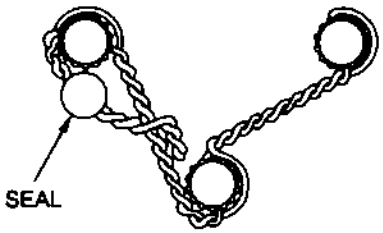
EXAMPLE 28



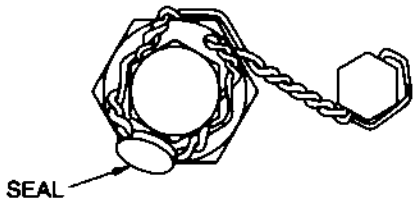
EXAMPLE 29



EXAMPLE 30



EXAMPLE 31

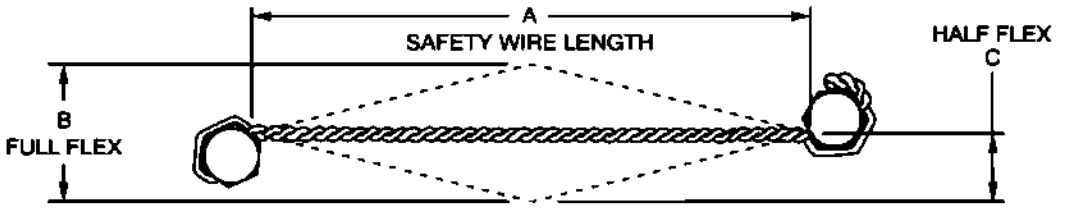


EXAMPLE 32

SEAL ATTACHED TO PROTECT
IMPORTANT ADJUSTMENTS.

G-11776 (0802)
PW V

Installation of Safety
Wire (Examples)
Figure 402 (Sheet 5)
(Task 70-00-00-400-043)



G-11779 (0802)
PW V

Index A Safety Wire Length (Span) Inch (mm)	Index B Full Flex Limit Inch (mm)	Index C Half Flex Limit Inch (mm)
0.5 (12.700 mm)	0.125 (3.175 mm)	0.063 (1.600 mm)
1.0 (25.400 mm)	0.250 (6.350 mm)	0.125 (3.175 mm)
2.0 (50.800 mm)	0.375 (9.525 mm)	0.188 (4.775 mm)
3.0 (76.200 mm)	0.500 (12.700 mm)	0.250 (6.350 mm)
4.0 (101.600 mm)	0.500 (12.700 mm)	0.250 (6.350 mm)
5.0 (127.000 mm)	0.625 (15.875 mm)	0.313 (7.950 mm)
6.0 (152.400 mm)	0.625 (15.875 mm)	0.313 (7.950 mm)

Installation of Safety Wire (Flex)
Figure 403
(Task 70-00-00-400-043)

Task 70-00-00-400-044:

1. Installation of Safety Cable

A. Effectivity

(1) All (727/8D, 737/8D, Super 27/8D, DC-9/8D)

B. General

(1) This task gives the general instructions for the correct installation of safety cable.

C. References

(1) Task 70-00-00-400-032, Standard Torques

D. Equipment

(1) Bergen Mechanical Crimper - Model M303, M305, or M307

R (2) PWA 87398 Crimper (equivalent to M303)

R (3) PWA 87399 Crimper (equivalent to M305)

R (4) PWA 87400 Crimper (equivalent to M307)

E. Consumable Materials

(1) (No specific) Safety Cable (as specified by the specific AMM maintenance task)

(2) (No specific) Safety Cable Ferrule (as specified by the specific AMM maintenance task)

F. Procedure - General Specifications

(1) Always obey the specific procedures and limits in the specific AMM maintenance tasks. The specific AMM maintenance task limits are for specific locations on the engine and for specific applications.

(2) Where safety cable is permitted in the specific AMM maintenance task, use the procedure which follows to install the cable.

(3) Generally you can use safety cable on the engine external parts. Do not use safety cable in the engine gaspath, on any external components, or on any fastener where the cable ferrule can go through the wire hole.

(4) You can replace safety cable with safety wire as necessary. Refer to the specific AMM maintenance task for the correct safety wire size for safety cable replacement.

(a) The correct safety wire and safety cable will be specified by part number in the specific AMM maintenance task. Use safety cable PN AS3510-0218C (0.032 inch diameter) and safety cable ferrule PN AS3510-02F on JT8D engines.

(b) Safety cable is permitted on JT8D engines at limited locations as an alternate to lockwire. Install safety cable by the procedures in this ection.

(c) Safety cable is permitted at all external and fan stream locations where the lockwire hole is sufficiently large for the cable, but not in these areas:

1 Locations where the lockwire hole is more than 0.100 inch diameter (the safety cable ferrule will pull through a hole larger than this).

2 Internal engine, gearbox, and accessory areas.

3 Heat shields (as lacing)

4 Vendor-controlled (Category 1) components

(5) Obey the maximum safety cable length limits which follow.

(a) The maximum length (span) of safety cable between two tension points is 6 inches (152.4 mm) maximum, unless specified differently by the specific AMM maintenance task.

G. Procedure

(1) Torque the parts before you install the safety cable as follows. See Figure 401.

(a) All fasteners must be correctly torqued before you install the safety cable.

R
R

(b) For two or more fasteners safetied together, you must also put the wire holes in a correct position in relation to each other.

(c) To get the correct hole alignment, torque the fasteners to the limits for fasteners with wire holes. Refer to the specific AMM maintenance task or the Standard Torques (Task 70-00-00-400-032).

(d) Do not decrease the torque less than the specified limit to correctly align the wire holes.

(e) Do not increase the torque more than the specified limit to correctly align the wire holes.

(f) If necessary, use another fastener or part to correctly align the wire holes within the specified torque limits.

(2) Get and examine the safety cable before installation as follows.

(a) Get new safety cable and its ferrule for each application. It is not permitted to use the safety cable and ferrule again.

(b) Examine the safety cable for nicks, frayed strands, kinks, or any damage.

(c) Damaged safety cable is not permitted, discard the damaged cable.

(3) Examine the safety holes as follows.

CAUTION: DO NOT USE SAFETY CABLE IF THE HOLES ARE MORE THAN 0.100 INCH (2.54 mm) DIAMETER. IF YOU DO, THE FERRULES ON THE END OF THE CABLE WILL PULL THROUGH THE LARGER HOLES.

(a) Make sure that the safety holes on the parts are less than 0.100 inch (2.54 mm) diameter. The ferrules on the end of the cable are 0.106 - 0.108 inch (2.693 - 2.743 mm) diameter and will pull through the holes larger than this.

CAUTION: DO NOT INSTALL THE SAFETY CABLE IN HOLES WITH BURRS OR SHARP EDGES. IF YOU DO, THE SAFETY CABLE CAN BREAK DURING ENGINE OPERATION.

(b) Examine the safety holes for burrs or sharp edges.

(c) Remove the burrs or sharp edges from the safety holes.

(d) If necessary replace the parts with burrs or sharp safety holes.

(4) Determine the direction and pattern of the safety cable for the parts that must be safetied. See Figure 401 for examples.

NOTE: Figure 401 (Sheet 1) and (Sheet 2) does not show every possible combination of parts that can be safetied. Use these figures as a guide for other applications.

(a) Install safety cable for a group of three bolts or screws as shown in Examples 1 and 2.

(b) Install safety cable for a group of two bolts or nuts as shown in Examples 3.

1 The safety holes can be aligned in a straight direction for the installation of safety cable.

2 Use groups of the two bolt pattern when you apply safety cable to an even number of fasteners.

(c) Install safety cable for two hollow head plugs as shown in Example 4.

(d) Install safety cable for tube and hose nuts as shown in Example 5.

(e) Install safety cable for tube nuts on a tee as shown in Example 6.

(f) Install safety cable for a coupling as shown in Example 7.

(g) Install safety cable for a tube tee with safety cable holes as shown in Example 8.

R
R

(h) Install safety cable for a filter cover as shown in Example 9.

(i) Install safety cable for a single hollow head plug to a lug with a safety cable hole as shown in Example 10.

(j) Install safety cable for a knurled nut as shown in Example 11.

(k) Install safety cable for rod ends with jam nuts as shown in Examples 12 and 13.

(5) Install the safety cable as follows.

(a) Always install safety cable through the safety cable or safety wire holes given on the part.

(b) Do not install the safety cable down through the bolt lightening holes. See Figure 401 (Sheet 2) Example 14.

(c) Install the safety cable so that it always applies tension to tighten the parts or a neutral pull.

(d) Safety cable is not a means to get or keep torque. It is a safety device used to prevent disengagement of the part.

(e) The maximum length (span) of safety cable between two tension points is 6 inches (152.4 mm) maximum, unless specified differently by the specific AMM maintenance task.

(f) Do not install the safety cable through the fasteners with sharp turns more than 90 degrees. This will produce installed safety cable with either a positive or neutral pull. The better condition is to have the cable clearly positive. Where this is not possible because of interference across an edge of a gusset, bracket, or other part, the neutral condition is acceptable.

(g) Crimp the ferrule to the cable with the Bergen Mechanical Crimper (Model M303, M305, or M307).

R NOTE: PWA 87398, 87399, and 87400 Crimpers
R (equivalent to M303, M305, and M307) are
R available from P&W.

1. The safety cable must meet the minimum crimp requirements of Table 401.

Nominal Cable Diameter	Minimum Pull-Off Load
0.020 Inch (0.508 mm)	30 lbf-in (3.390 N.m)
0.032 Inch (0.813 mm)	70 lbf-in (7.909 N.m)
0.040 Inch (1.016 mm)	130 lbf-in (14.688 N.m)

NOTE: The pull-off load is the force necessary to pull the cable out of either the ferrule or the cable end fitting.

Safety Cable Minimum Crimp Requirements (Pull-Off Load)
Table 401

(h) Crimp a lead seal to the safety cable when specified by the specific AMM maintenance task.

(6) Trim off the unwanted safety cable as follows.

(a) The Bergen Mechanical Crimper (Model M303, M305,
R or M307) (or PWA 87398, PWA 87399, or PWA 87400
R Crimper) cuts the cable to the correct length when you crimp the ferrule.

CAUTION: BE SURE THAT THE CUT CABLE ENDS DO NOT FALL INTO THE ENGINE. IF THEY DO, THE SAFETY CABLE CAN CAUSE DAMAGE DURING ENGINE OPERATION.

(b) Cut off excess cable from the crimped ferrule with wire cutter pliers.

(c) Make sure that the maximum length of unwanted cable past the crimped ferrule is 0.031 inch (0.787 mm).

(7) Examine the safety cable after installation as follows.

(a) Examine the safety cable for damage as follows.

1. Examine the safety cable for nicks, frayed strands, kinks, or any damage.

2. Damaged safety cable is not permitted.

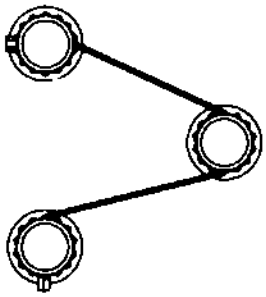
3 Remove and replace the damaged safety cable.

(b) Examine the safety cable for flex limits as follows.

1 Push on the safety cable at mid-span with light finger pressure, approximately 2 lbs (0.91 kg).

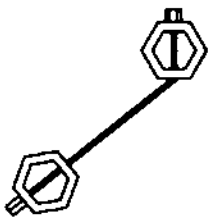
2 The total flex for the safety cable must not be more than the limits shown in Figure 402.

EXAMPLE 1
BOLTS



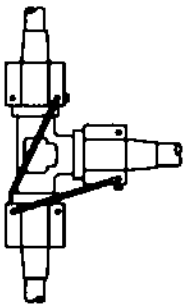
EXAMPLE 2
BOLTS

EXAMPLE 3
BOLTS



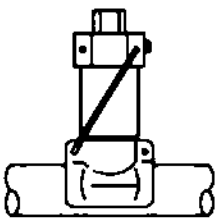
EXAMPLE 4
PLUGS

EXAMPLE 5
HOSE AND TUBE NUTS



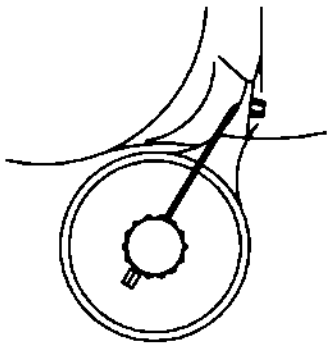
EXAMPLE 6
TUBE TEE

EXAMPLE 7
COUPLINGS



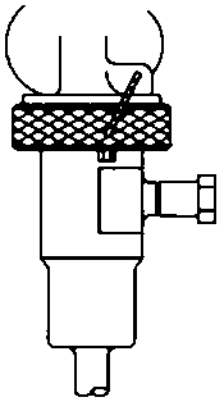
EXAMPLE 8
TUBE TEE

G-01002 (0802)
PW V

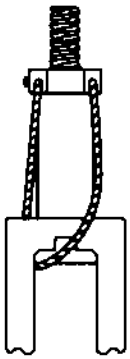


EXAMPLE 9
FILTER COVER

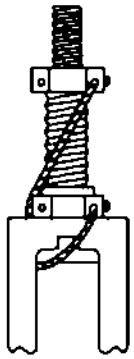
EXAMPLE 10
PLUG



EXAMPLE 11
KNURLED NUT



EXAMPLE 12
ROD END

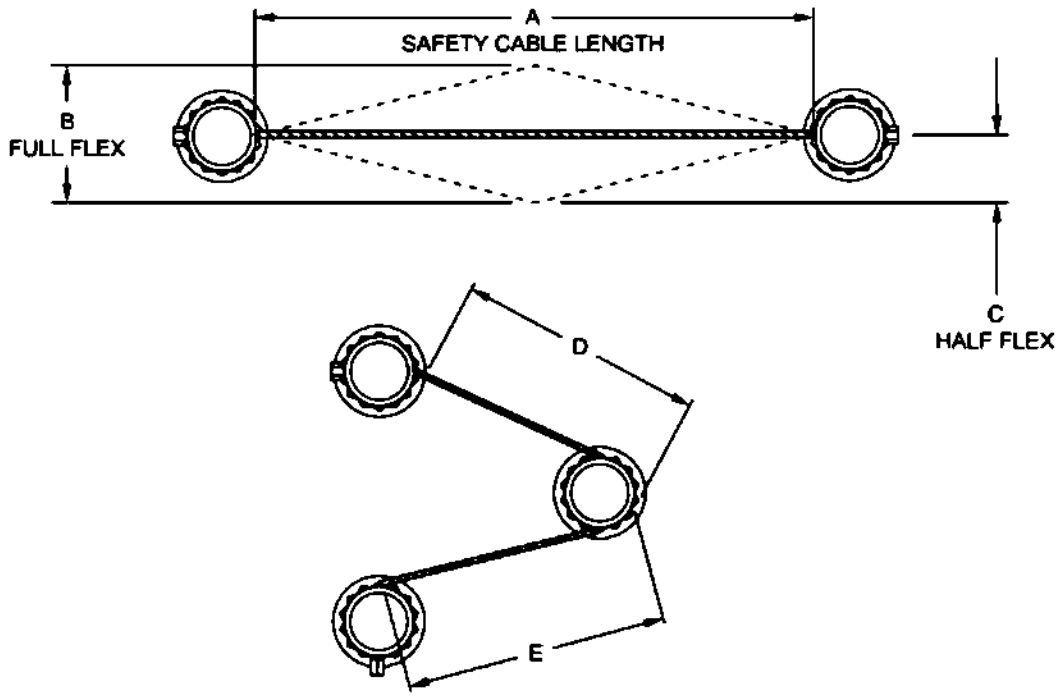


EXAMPLE 13
ROD END

EXAMPLE 14
UNSATISFACTORY INSTALLATION

G-01003 (0802)
PW V

Installation of Safety
Cable (Examples)
Figure 401 (Sheet 2)
(Task 70-00-00-400-044)



Index A Safety Wire Length (Span) Inch (mm)	Index B Full Flex Limit Inch (mm)	Index C Half Flex Limit Inch (mm)
0.5 (12.700 mm)	0.125 (3.175 mm)	0.063 (1.600 mm)
1.0 (25.400 mm)	0.250 (6.350 mm)	0.125 (3.175 mm)
2.0 (50.800 mm)	0.375 (9.525 mm)	0.188 (4.775 mm)
3.0 (76.200 mm)	0.375 (9.525 mm)	0.188 (4.775 mm)
4.0 (101.600 mm)	0.500 (12.700 mm)	0.250 (6.350 mm)
5.0 (127.000 mm)	0.500 (12.700 mm)	0.250 (6.350 mm)
6.0 (152.400 mm)	0.625 (15.875 mm)	0.313 (7.950 mm)

Installation of
Safety Cable (Flex)
Figure 402
(Task 70-00-00-400-044)

Task 70-00-00-400-050:

1. Installation of Ball and Roller Bearings (SPOP 429)

A. Effectivity

(1) All (727/8D, 737/8D, Super 27/8D, DC-9/8D)

B. General

(1) This task gives the general instructions for the handling, heating, and installation of ball and roller bearings.

C. References

(1) Task 70-00-00-400-032, Standard Torques

(2) Task 70-30-00-990-002, Supplier Source Code List

D. Equipment

(1) (No specific) Bearing Gloves, Lint Free

E. Consumable Materials

NOTE: The P- numbers shown in this list are used by other Pratt & Whitney engine programs and are included to keep this list common with those in other engine and airframe programs.

(1) (P03-001) Engine Oil (PWA 521)

R (2) (P03-19) Lubricating and Preservation Oil (PMC 9123,
R MIL-PRF-6085)

R NOTE: P03-19 is an alternate to P03-001.

R (3) (P05-005) Lint Free Cotton Cloth

F. Procedure - General Instructions

CAUTION: DO NOT TOUCH ENGINE BEARINGS WITH YOUR BARE HANDS. USE GLOVES TO PROTECT THE ENGINE BEARINGS. IF YOU DO NOT OBEY THIS CAUTION, DAMAGE TO THE BEARING CAN OCCUR.

(1) Always obey the specific procedures and limits in the specific AMM maintenance tasks.

(2) Wear a clean pair of bearing gloves, made of an approved lint free material when you handle bearings.

(3) When you assemble inner races of bearings on their mating shafts, expand the inner race with controlled heating.

(a) You can heat the inner race of demountable bearings and complete bearing assemblies of nondemountable bearings to the necessary temperature by immersion in a controlled hot oil bath, or with an oven or induction heater.

(b) Check shafts and bearing races for size and trueness before heating to prevent abnormal fits.

(4) It is important to keep the area clean regardless of whether you use a hot oil bath, an oven, or an induction heater.

(5) Hot Oil Bath

(a) This used to be the typical heating method for bearings and other parts because of the anti-corrosion characteristics of oil. There are now environmental and safety concerns which make other methods a better choice.

(b) Be sure to put a cover on the tank to minimize contamination of the oil by airborn dirt and abrasives. It is important to change the oil and clean the tank regularly, as necessary.

(c) Do not permit bearings to rest on the bottom of the tank because the settlings can cause contamination and the bearing temperature will be much greater than the indicated oil temperature. A heavy screen or series of rods that extend at least 3 inches (76.2 mm) above the tank bottom will keep the bearings surrounded by oil at an equal temperature and will permit any dirt to settle to the bottom of the tank.

R (d) Use clean (P03-001) Engine Oil (PWA 521) or
R (P03-019) Lubricating and Preservation Oil (PMC
R 9123, MIL-PRF-6085) in the hot oil bath with a controlled temperature not be more than 250°F (121°C) unless specified differently in the specific AMM maintenance task.

(6) Oven

(a) An oven may not increase the temperature of the part as fast as an induction heater, but there is less potential to increase the temperature of the part too much. An oven gives an equal amount of heat to large or complex parts and thus minimizes distortion and thermal stress.

R (b) A film of (P03-001) Engine Oil (PWA 521)or
R (P03-019) Lubricating and Preservation Oil (PMC
R 9123, MIL-PRF-6085) must be on each part before it goes into the oven. (P03-001) Engine Oil (PWA 521) prevents corrosion before, during, and after assembly.

(c) The oven temperature must not be more than 250°F (121°C) unless specified differently in the specific AMM maintenance task.

(7) Induction Heater

R (a) A film of (P03-001) Engine Oil (PWA 521) or
R (P03-019) Lubricating and Preservation Oil (PMC
R 9123, MIL-PRF-6085) must be on each part before
R the induction heater is used to increase the
R temperature of the part. (P03-001) or (P03-019)
R Oil prevents corrosion before, during, and after assembly.

(b) An induction heater increases the temperature of a part quickly and does not have the environmental concerns of the hot oil bath, but to know how to get the correct temperature takes experience. Be sure to follow the manufacturer's instructions, warnings, and cautions.

1 PW has induction heater experience with units (Models TIH 020, TIH 050, TIH 100, and TIH 120) supplied by SKF Industries, units (Models 1x and 4x) supplied by Eddytherm and units (Foucault 22 ESD Swing Arm (PWA 89127)) by Foucault International Corporation. Refer to the Supplier Source Code List (Task 70-30-00-990-002).

Registered Trademark	Supplier Code
Eddytherm	C4298 and 75957
Foucault	EQ032
SKF	2M749

(c) Magnetism can be induced by induction heaters. Therefore, after induction heating, be sure to examine bearings for any remaining magnetism as follows.

1 Ball and roller bearings are at all times susceptible to magnetic adherence of small unwanted particles.

2 Limits for remaining magnetism are ± 2 gauss.

3 Demagnetize nonseparable bearings as assemblies. Slowly turn the inner and outer races in opposite directions when the bearing goes through the demagnetizer.

4 Demagnetize separable bearings one component at a time.

5 The components of a disassembled bearing must be kept together.

6 Remove bearing from the demagnetizer.

(d) There frequently is a degaussing feature built into the induction heater, but it may be inoperative (no indicating device to define if or when the degausser is functional or if there is a degausser feature).

(e) Bearing temperatures must not be more than 250°F (121°C) unless specified differently in the specific AMM maintenance task. Be sure to wear insulated, clean, lint-free gloves when you touch heated bearings.

G. Installation

(1) Handle the bearing as follows.

(a) Do not touch the bearing with your bare hands.

(b) Put clean gloves on your hands.

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R

(c) Put the bearing on a piece of clean bearing paper.

(d) Separate the outer race from the inner race.

(e) For separable bearings, verify that the serial numbers on the inner and outer races are the same.

(2) Before you install a main bearing, wipe excess oil from the journal of the shaft, hub, or gear with a clean (P05-005) Lint Free Cotton Cloth and apply a lubricant as specified in the specific AMM maintenance task. Force must not be used in the assembly of parts. If there is any difficulty, disassemble parts and examine them for burrs or other interference.

(3) When a roller bearing is installed, turn the rollers with respect to the outer race. This will reduce the possibility of hang up of the rollers and will also increase the sensitivity of detection of the hang up.

(4) Manufacturer's number on bearing races must face the operator, as bearing is installed, unless specified differently in the specific AMM maintenance task.

(5) Large spannernuts used to secure main bearings or seals to shafts and housings frequently have small burrs at spanner slots. These burrs can cause damage to the bearing surfaces and cause incorrect torques. Deburr spannernuts with this condition.

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Task 70-00-00-230-001:

1. Fluorescent Penetrant Inspection (Local Application) Normal or High or Ultra High Sensitivity (SPOP 70)

R WARNING: REFER TO THE MANUFACTURERS' MATERIAL SAFETY DATA
R SHEETS FOR CONSUMABLE MATERIAL INFORMATION, FOR
R EXAMPLE HAZARDOUS INGREDIENTS, PHYSICAL/CHEMICAL
R CHARACTERISTICS, FIRE, EXPLOSION, REACTIVITY, HEALTH
R HAZARD DATA, PRECAUTIONS FOR SAFE HANDLING, USE AND
R CONTROL MEASURES.

NOTE: SPOP 70 is for the inspection of small areas of a part (for example bosses, weld-repaired areas, routed or ground areas, and blend areas). This SPOP is not for full-circumference (360 degree) inspections (for example
R on flanges, seals or knife-edges), or to replace a 100
R percent inspection.

A. Effectivity

(1) All (727/8D, 737/8D, Super 27/8D, DC-9/8D)

B. General

(1) This task gives the general instructions and the approved materials for fluorescent penetrant inspection (local application) normal or high or ultra high sensitivity.

C. References

(1) Task 70-00-00-100-004, Degreasing of Parts by Solvent Wiping (SPOP 208)

D. Equipment

(1) (No specific) UV Light

(2) (No specific) UV Light Meter

(3) (No specific) White Light Meter

E. Consumable Materials

NOTE: The P- numbers shown in this list are used by other Pratt & Whitney engine programs and are included to keep this list common with other engine and airframe programs

(1) (P05-032) Fluorescent Penetrant (Post-Emulsified) (PMC 4353)

R (2) (P05-034) Dry Developer (PMC 4356)

(3) (P05-234) Fluorescent Penetrant (Post-Emulsified) (PMC 4352)

(4) (P05-235) Fluorescent Penetrant (Post-Emulsified) (PMC 4354)

(5) (P05-236) Fluorescent Penetrant (Water Washable) (PMC 4360)

(6) (P05-237) Fluorescent Penetrant Developer (Non-aqueous) (PMC 4357)

(7) (P05-424) Fluorescent Penetrant (Water Washable) (PMC 4351)

(8) (P11-014) Isopropyl Alcohol (PMC 9094)

(9) (P11-032) Acetone (PMC 9008)

(10) (P11-038) Solvent Cleaner (PMC 8904)

(11) (P11-039) Solvent Cleaner (PMC 9060)

(12) (P11-042) Fluorescent Penetrant Cleaner/Remover (PMC 4366)

F. Procedure - General Instructions

(1) Always obey the specific procedures and limits in the AMM maintenance task.

CAUTION: DO NOT USE A VISIBLE DYE PENETRANT ON AN ENGINE PART BEFORE YOU INSPECT THE PART WITH FLUORESCENT PENETRANT. FLUORESCENT PENETRANTS AND VISIBLE DYE PENETRANTS ARE NOT COMPATIBLE WITH EACH OTHER. THE ABSORPTION OF VISIBLE DYE PENETRANT WILL MASK INDICATIONS AND

DECREASE THE SENSITIVITY OF THE FLUORESCENT PENETRANT INSPECTION.

CAUTION: DURING INSPECTION, DO NOT WEAR EYE GLASSES THAT HAVE LENSES WHICH DARKEN WHEN THEY ARE
R IN ULTRAVIOLET LIGHT (UVL).

R (2) Always use "ultra" high sensitivity penetrant on
R major rotating parts (fan blades, compressor blades,
R drums, disks, airseals, and hubs, and turbine disks,
R airseals, hubs, seal plates (full rings and segments)
R and shafts) during SPOP 70 operations. In some tasks the "ultra" high sensitivity penetrant is not specified on these major rotating parts. Service experience shows that "ultra" high sensitivity penetrant must be used (instead of high) on all major rotating parts.

G. Procedure - Cleaning Instructions

(1) Wipe the inspection area with a clean cloth wet with a solvent from SPOP 208 to remove all unwanted material.
R Refer to Cleaning/Painting-04 (Task 70-00-00-100-004).

R (2) Do not let the solvent flow across or flood part
R surfaces.

H. Procedure - Inspection Instructions

R (1) Apply masking tape to the adjacent area when necessary
R to prevent penetrant contamination where it is
R unwanted.

R (2) Apply the applicable penetrant (normal, high, or ultra high), as specified by the specific AMM maintenance
R task, with a brush, cloth, or cotton swab. Let the
R penetrant stay on the part surface for 20 - 60 minutes.

(a) Do not mix different types or brands of penetrant.

(b) Normal Penetrants

1 (P05-234) Fluorescent Penetrant (Post-Emulsified) (PMC 4352).

R 2 (P05-424) Fluorescent Penetrant
R (Water-Washable) (PMC 4351).

(c) High Penetrants

1 (P05-032) Fluorescent Penetrant (Post-Emulsified) (PMC 4353).

R 2 (P05-236) Fluorescent Penetrant (Water
R Washable) (PMC 4360).

(d) Ultra High Penetrants.

1 (P05-235) Fluorescent Penetrant (Post-Emulsified) (PMC 4354).

R (3) Wipe surfaces with a cloth or paper towel and a SPOP
R 208 solvent to remove surface penetrant. Refer to
R Cleaning/Painting-04 (Task 70-00-00-100-004). Use
R the solvent only to moisten the wiper and only if
R necessary. Do not let the solvent flow across or flood
R part surfaces

R NOTE: It is very important not to wipe surfaces too
R much (this can remove penetrant from the part).

R (4) Use the UVL to make sure that there is no more
R penetrant on the surface.

R (5) Very lightly apply one of these developers:

R (a) (P05-237) Fluorescent Penetrant Developer
R (Non-aqueous) (PMC 4357).

R 1 Apply non-aqueous developer in an even coat,
R sufficiently thick to see but not so thick that
R the color of the part is not seen.

R (b) (P05-034) Dry Developer (PMC 4356).

R (6) Let the developer absorb the penetrant for 10 minutes
R minimum.

R CAUTION: YOU MUST DO THIS INSPECTION IN A DARK
R AREA. WHITE LIGHT MUST NOT BE MORE THAN 2
R FOOTCANDLES (20 LUX) AT THE INSPECTION
R SURFACE. TO MAKE THE AREA DARK, YOU CAN COVER
R IT WITH A BLACK CLOTH.

R (7) Examine the part under UVL for indications.

R (8) If any area shows moderate fluorescent background or
any marginally unacceptable or questionable indication,
continue as follows.

(a) Lightly rub the suspect area with a soft brush or cotton swab wet with a solvent from SPOP
R 208. Refer to Cleaning/Painting-04 (Task
R 70-00-00-100-004).

R (b) Do not let the liquid flow across or flood part
R surfaces.

R (c) Let the liquid evaporate from the surface and then
R examine the area again with UVL.

R (d) If the indication appears again immediately,
R examine the indication.

R (e) If the indication does not appear again
R immediately, apply the dry or non-aqueous
R developer to the area. Let the developer absorb
R the penetrant for 10 minutes minimum and then
R examine the area in question again with UVL.

R NOTE: No cracks are permitted unless specified
R differently by an AMM task.

R (f) Use this evaluation procedure only once on any indication.

R (9) Remove the developer.

R NOTE: Removal of developer is only necessary if it
R interferes with subsequent processing or part
R function.

R (a) If there are no areas on the part to catch
R contamination, before visual/dimensional
R inspection blow off remaining developer if
R necessary.

R (b) If there are areas on the part which could catch
R contamination by dry developer, flush the part
R with hot water to clean it.

R (c) If a non-aqueous developer was used, remove it by
R SPOP 208. Refer to Cleaning/Painting-04 (Task
R 70-00-00-100-004).

Task 70-00-00-990-007:

1. Preparation of Blue Dye Oil System Leak Check Solution (PS 197)

A. Effectivity

(1) All (727/8D, 737/8D, Super 27/8D, DC-9/8D)

B. General

(1) This task gives the general instructions to make up the PS 197 Blue Dye Solution used in oil system leak checks.

C. References - None

D. Equipment

(1) (No specific) Container, Mixing

E. Consumable Materials

NOTE: The P- numbers shown in this list are used by other Pratt & Whitney engine programs and are included to keep this list common with other engine and airframe programs.

(1) (P03-001) Oil, Engine Lubricating (PWA 521, Type II)

(2) (P05-459) Dye, Blue (PMC 4513)

F. Procedure - General Instructions

(1) Always obey the specific procedures and limits in the AMM maintenance task.

G. Procedure - Make-Up of PS 197 Blue Dye Solution

	Materials	Make-Up	Operating Limits
R	Dye, Blue (Material No. P05-459)	5 - 6 milliliters	150 ± 40 ppm
	Oil, Engine Lubricating (Material No. P03-001)	10 gallons (37.85 liters)	

(CONTINUED)

R NOTE: When the engine is first refilled with oil without
R dye, this oil will mix with remaining dyed oil.
R The color of this mixture can possibly be darker
R than the oil (without dye) that was added. Oil
R color can be different from one brand of oil to
R another. This color change is permitted and is
R not an indication of problems in the lubrication
R system.

H. Procedure - Preparation Instructions

(1) Add the specified amount of Engine Lubricating Oil (Material No. P03-001) to the mixing container.

NOTE: The selection of base oil (Approved PWA 521, Type II) will make it easier for the operator to see the blue color of the dyed oil. Pratt & Whitney experience finds that light color PWA 521, Type II base oils are more easily detected with the Blue Dye (Material No. P05-459).

(2) Add the specified amount of Blue Dye (Material No. P05-459).

(3) Stir to mix.

I. Procedure - Precaution Instructions

NOTE: This solution is organic.

(1) Do not permit the solution to touch the skin, eyes, nose, or throat.

(2) Do not take this solution internally.

(3) Be sure to wash fully after handling and before you drink or smoke.

(4) Keep this solution away from food.

(5) Do not breathe the dust, vapors, mists, or gases.

(6) Use this solution with sufficient ventilation.

(7) Keep this solution away from heat or flames; toxic mixtures can occur.

(8) Be sure to wear the necessary safety equipment.

(9) Keep this solution away from oxidizers.

Task 70-00-00-100-001:

1. Cleaning Requirements After Chemical Contact With Fire Extinguishing Agents, Hydraulic Fluid, Oil, or Fuel (SPOP 425)

A. Effectivity

(1) All (727/8D, 737/8D, Super 27/8D, DC-9/8D)

B. General

(1) This task gives the general instructions and the approved materials for cleaning of the engine after chemical contact with fire extinguishing agents, hydraulic fluid, oil, or fuel.

C. Consumable Materials

NOTE: The P- number references in this list are applicable to other Pratt & Whitney engine and airframe programs and are not applicable to JT8D. They are included here to keep this list common with those in other engine/airframe programs.

(1) (P11-049) Aqueous Cleaner (SPMC 148)

D. Procedure - General Instructions

R See Figure 701 (Sheet 1) and Figure 701 (Sheet 2).

(1) Always obey the specific procedures and limits in the specific AMM maintenance tasks.

R (2) SPOP 425 gives operators the cleaning and disassembly
R requirements for engines that come in contact with
R (touch) fire extinguisher agents during a fire in the
R burner (combustor) and/or gaspath areas of the engine,
R or that come in contact with hydraulic fluid, oils, or
R fuel. Contact (speak or write to) the local Pratt &
R Whitney representative for the applicable requirements
R and procedures when the subsequent conditions occur:

R (a) The engine comes in contact with a fire
R extinguisher agent when there is no fire (for
R example, during accidental operation of the fire
R extinguisher system).

R (b) The fire temperature was higher than the engine
R over-temperature limits.

R (c) The fire occurred in areas other than the burner
R and gaspath areas of the engine.

R (3) After a fire extinguisher agent goes into the engine,
R do not operate the engine if Figure 701 (Sheet 1) or
R Figure 701 (Sheet 2) shows that the fire extinguisher
R agent makes it necessary to disassemble the engine.
R Some fire extinguisher agents can cause damage to
R engine parts at engine operation temperatures.

R (4) If you used carbon dioxide, nitrogen, Ansul Inergen,
R water, or water fog to extinguish a tail pipe fire,
R and the post-fire inspection finds no fire damage or
R mechanical damage, then it will not be necessary to
R disassemble the engine to clean the engine parts. See
R Figure 701 (Sheet 1). For many other fire extinguisher
R agents, it is necessary to disassemble the engine to
R satisfactorily clean the parts that came in contact
R with the fire extinguisher agent. See Figure 701
R (Sheet 1) and Figure 701 (Sheet 2).

R (5) Before you do maintenance work on a hangar fire
R extinguisher system that uses foam, remove engines from
R the hangar or put covers on the engines to make sure
R that accidental operation of the system does not cause
R foam to go into the engine.

R (6) Necessary detailed procedures for gaspath cleaning
R (internal wash), and instructions for subsequent
R disassembly, cleaning, and inspection, are in the
R applicable AMM Maintenance Manuals.

R (7) If operators who know of airports, test cells, or
R hangars that use fire extinguisher agents that are not
R in the list in Figure 701 (Sheet 1) and Figure 701
R (Sheet 2), then they must give instructions to their
R local Pratt & Whitney representative to send the
R Technical Data Sheets and Material Safety Data Sheets
R for these fire extinguisher agents to Pratt & Whitney
R Customer Service in East Hartford, Connecticut.

R (8) The primary concern when foam or dry chemical fire
R extinguisher agents go into an engine is corrosion
R during subsequent engine operation. The engine
R operation environment can cause chemical reactions of
R the fire extinguisher agents, which then can cause
R corrosion on cold-section and/or hot-section parts.

R (9) Tests show these results:

(a) Stainless steel alloys, nickel base alloys (coated or uncoated), and cobalt base alloys show a high
R risk of chemical corrosion from some types of fire
R extinguisher agents (for example, protein foams
R and dry chemical agents), at temperatures much
R below the engine operation range.

(b) Titanium, aluminum, magnesium, cadmium plated and nickel-cadmium plated low alloy steels show no signs of corrosion from bicarbonate compounds (dry
R powders) at engine operation temperatures.

R (c) Many of the foam fire extinguisher agents in
R the list in Figure 701 (Sheet 2) cause stress
R corrosion cracks in titanium at the service
R operation temperatures in the high pressure
R compressor, but not at the service operation
R temperatures of the fan. Thus, it is permitted to
R hand wipe clean with (P11-049) Aqueous Cleaner
R (SPMC 148) to remove overspray of foam fire
R extinguisher agents from fan blades.

R (d) Some of the aqueous film-forming foam (AFFF) and
R high-expansion foam chemical fire extinguisher
R agents in the list in Figure 701 (Sheet 2) do not
R cause corrosion on engine material test panels at
R engine operation temperatures. Figure 701 (Sheet
R 2) shows which AFFF and high-expansion foam agents
R have test results that show they are compatible
R with engine alloys and coatings. For other AFFF
R and high-expansion foam agents, it is necessary to
R disassemble the engine to remove the parts that
R came in contact with the foam.

R (10) Halon 1301 fire extinguisher agent decomposes in fires
R and at engine operation temperatures to make acids that
R can cause corrosion of, or stress corrosion cracks in,
R gaspath materials at high temperatures. Tests show
R that Halon 1301 can degrade turbine airfoil coatings at
R 1800°F (982°C) in a short period of time.

R (a) Fire extinguisher systems that release Halon 1301
R directly into the core of the engine (for example,
R ground units) can cause the turbofan airfoils to
R come in contact with the Halon 1301.

R (b) Onboard nacelle Halon 1301 fire extinguisher systems usually do not cause the turbine airfoils to come in contact with the Halon 1301 because these systems release the Halon 1301 into the nacelle compartment and not directly into the engine core. Thus, it is usually not necessary to clean engine gaspath parts to remove Halon 1301 decomposition materials after an onboard nacelle fire extinguisher system releases Halon 1301.

R (11) The aqueous film-forming foams (AFFF) in Figure 701 (Sheet 2) are NFPA Class B foam fire extinguisher agents that use synthetic surfactants, which are usually fluorinated. These foams do not contain protein foaming agents.

R (12) The high-expansion foams in Figure 701 (Sheet 2) are NFPA Class B foam fire extinguisher agents that expand quickly to fill closed spaces (for example, hangars). These foams usually use synthetic surfactants that are different from the synthetic surfactants in aqueous film-forming foams.

R (13) The protein (P), fluoroprotein (FP), and film-forming fluoroprotein (FFFP) foams in Figure 701 (Sheet 2) are NFPA Class B foam fire extinguisher agents that use protein foaming agents.

R E. Cleaning After Chemical Contact with Fire Extinguisher Agents

R (1) After a fire, or after you use an onboard nacelle fire extinguisher system because of a cockpit fire warning, do an inspection of the engine for fire damage:

R (a) Turn the rotor manually to do a check to make sure that the rotor turns freely:

R 1 The rotor must turn freely. A rotor that does not turn freely is a sign of damage.

R 2 While the rotor turns, listen for parts that rub against or hit other parts that they usually do not touch. Such noises are signs of damage.

R (b) Do a visual inspection of the external surfaces of the engine to look for fire damage.

R (c) Do a borescope inspection of the engine to see
R which parts have fire damage.

R (d) If the check for free movement finds one or more
R signs of damage, the visual inspection finds fire
R damage, and/or the borescope inspection finds fire
R damage, then it is necessary to remove the engine
R from the airframe and to disassemble the engine to
R remove the parts that have damage.

R (2) In engine models that use labyrinth seals, do a check
R for contamination of the oil systems because the
R materials in the list in Figure 701 (Sheet 1) and
R Figure 701 (Sheet 2) could enter the oil system through
R the labyrinth seals.

R (3) See Figure 701 (Sheet 1) and Figure 701 (Sheet 2) for
R the inspection, cleaning, and disassembly requirements
R for engines that come in contact with fire extinguisher
R agents during a fire. The procedures for the
R requirement in each column of Figure 701 (Sheet 1) and
R Figure 701 (Sheet 2) are in the subsequent list:

R (a) Visual/Borescope Inspection - Figure 701 (Sheet 1)
R and Figure 701 (Sheet 2), Column 2

R 1 If Column 2 says "YES" for the material in
R Figure 701 (Sheet 1) and Figure 701 (Sheet 2),
R then do the subsequent procedure:

R a Do a visual inspection of the external
R surfaces of the engine to see which parts
R have contamination from the material.

R b Do an internal borescope inspection to see
R which parts have contamination from the
R material.

R NOTE: This inspection will show how much
R of the engine you must disassemble
R to remove the parts that have
R contamination from the material.

R NOTE: This inspection does not show
R contamination from gaseous fire
R extinguisher agents or vaporizing
R liquid fire extinguisher agents.

R 2. If Column 2 says "N/R" for the material in Figure 701 (Sheet 1) or Figure 701 (Sheet 2), then it is not required (that is, it is permitted, but not necessary) to do a borescope inspection of the engine to look for contamination.

R (b) External Wash - Figure 701 (Sheet 1) and Figure 701 (Sheet 2), Column 3

R 1. If Column 3 says "YES" for the material in Figure 701 (Sheet 1) or Figure 701 (Sheet 2), then do an external wash to remove the material from the external surfaces of the engine that had chemical contact with the material. Use this procedure:

R a. Use Cleaning of Electrical Harnesses and Contact Points (SPOP 6) to clean electrical harnesses and contact points. Refer to 70-00-00, Cleaning/Painting-20 (Task 70-00-00-100-020).

R b. Use Cleaning the Exterior of the Engine (SPOP 1) to clean other external surfaces. Refer to 70-00-00, Cleaning/Painting-02 (Task 70-00-00-100-002).

R 2. If Column 3 says "NO" for the material in Figure 701 (Sheet 1) or Figure 701 (Sheet 2), then do not do an external wash.

R 3. If Column 3 says "N/R" for the material in Figure 701 (Sheet 1) or Figure 701 (Sheet 2), then it is not required (that is, it is permitted, but not necessary) to do an external wash to remove the material from the external surfaces.

R (c) Internal Wash - Figure 701 (Sheet 1) and Figure 701 (Sheet 2), Column 4

R 1. If Column 4 says "YES" for the material in Figure 701 (Sheet 1) and Figure 701 (Sheet 2), then do an internal (gaspath) wash of the engine to remove the material from the engine gaspath surfaces. Refer to the applicable AMM maintenance task for the gaspath wash procedures.

R CAUTION: IF YOU OPERATE THE ENGINE AFTER
R ENGINE GASPATH PARTS COME IN CONTACT
R WITH THE MATERIAL, THE MATERIAL COULD
R CAUSE DAMAGE TO THESE PARTS AT ENGINE
R OPERATION TEMPERATURES.

R 2. If Column 4 says "NO" for the material in
R Figure 701 (Sheet 1) or Figure 701 (Sheet 2),
R then it is not permitted to do an internal
R (gaspath) wash. Do not operate the engine
R after engine gaspath parts come in contact with
R the material.

R NOTE: It is not possible to fully remove foam
R fire extinguisher agents from the engine
R gaspath by an internal wash (with plain
R water or with detergent).

R NOTE: Dry chemical fire extinguisher agents
R are not water soluble. Thus, an
R internal wash will cause these materials
R to cake, bond to engine parts, and/or
R cause air holes and cavities to become
R clogged.

R a. If you or some other operator does an
R internal wash after engine gaspath parts
R come in contact with the material, then it
R will be necessary to remove and clean all
R parts in the engine gaspath.

R 3. If Column 4 says "N/R" for the material in
R Figure 701 (Sheet 1) or Figure 701 (Sheet
R 2), then it is not required (that is, it is
R permitted, but not necessary) to do an internal
R (gaspath) wash to remove the material from
R engine gaspath surfaces.

R (d) Disassemble/Clean By Engine Manual - Figure 701
R (Sheet 1) and Figure 701 (Sheet 2), Column 5

R 1. If Column 5 says "YES" for the material in
R Figure 701 (Sheet 1) or Figure 701 (Sheet 2),
R then disassemble the engine to clean the parts
R that have contamination. Use the subsequent
R procedure:

R **CAUTION:** IF YOU OPERATE THE ENGINE AFTER ENGINE GASPATH PARTS COME IN CONTACT WITH THE MATERIAL, THE MATERIAL COULD CAUSE DAMAGE TO THESE PARTS AT ENGINE OPERATION TEMPERATURES.

R a Do not operate the engine after the engine has chemical contact with the material.

R b Complete this procedure as soon as possible after the parts have chemical contact with the material.

R c For gaseous fire extinguisher agents or vaporizing liquid fire extinguisher agents, disassemble the engine to remove all parts in the engine gaspath.

R d For foam fire extinguisher agents or dry chemical fire extinguisher agents, disassemble the engine to remove those parts on which the visual/borescope inspection found contamination.

R · If you or some other operator did a gaspath wash after the material went into the engine, then it is necessary to remove and clean all parts in the engine gaspath.

R e Use the applicable AMM maintenance task for instructions to clean the parts.

R f After the parts are clean, do a visual inspection of all parts that had chemical contact. Use the applicable AMM maintence task for inspection limits.

R 2 If Column 5 says "N/R" for the material in Figure 701 (Sheet 1) or Figure 701 (Sheet 2), then it is not required (that is, it is permitted, but not necessary) to disassemble the engine to clean the parts.

R F. Cleaning After a Hydraulic Fluid Leak

R (1) After a hydraulic fluid leak, do the subsequent procedure:

R (a) Complete this procedure as soon as possible after
R contamination from hydraulic fluid occurs.

R (b) Do a visual inspection of the external surfaces of
R the engine to see which parts have contamination
R from hydraulic fluid.

R 1 If external surfaces show baked-on or burned
R hydraulic fluid, contact the local Pratt
R & Whitney representative for the applicable
R requirements and procedures.

R 2 If external surfaces show wet hydraulic fluid
R with no indication of baked-on or burned
R hydraulic fluid, then do the subsequent steps
R in this procedure.

R (c) If the visual inspection of the external surfaces
R of the engine finds indications that hydraulic
R fluid went into the engine through bleed valves,
R the inlet, or the exhaust, then do an internal
R borescope inspection to see which parts have
R contamination from the hydraulic fluid.

R NOTE: This inspection will show how much of the
R engine you must disassemble to remove the
R parts that have contamination from the
R hydraulic fluid.

R 1 If gaspath surfaces show contamination from
R hydraulic fluid, then it is necessary to remove
R the parts that have contamination from the
R hydraulic fluid for better cleaning.

R 2 It is not permitted to do an internal wash
R to remove hydraulic fluid from the gaspath
R surfaces.

R (d) If the visual inspection of the external surfaces
R of the engine found wet hydraulic fluid with no
R indication of baked-on or burned hydraulic fluid,
R then do an external wash to remove the hydraulic
R fluid from the external surfaces of the engine.
R Use the subsequent procedure:

R 1. Use Cleaning of Electrical Harnesses and
R Contact Points (SPOP 6) to clean electrical
R harnesses and contact points. Refer to
R 70-00-00, Cleaning/Painting-20 (Task
R 70-00-00-100-020.

R 2. Use one of the procedures in the subsequent
R list to clean other external surfaces:

R a. Use Cleaning the Exterior of the Engine
R (SPOP 1) to clean other external surfaces.
R Refer to 70-00-00, Cleaning/Painting-02
R (Task 70-00-00-100-002).

R b. Use Degrease Engine Parts by Solvent
R Wipe (SPOP 208) to remove grease from
R other external surfaces. Refer to
R 70-00-00, Cleaning/Painting-04 (Task
R 70-00-00-100-004).

R 3. After the above steps, do a visual inspection
R to look for remaining hydraulic fluid varnish
R or baked-on hydraulic fluid.

R (e) If the visual inspection after the external
R wash finds remaining hydraulic fluid varnish or
R baked-on hydraulic fluid, then do the subsequent
R procedure:

R 1. Disassemble the engine to remove those parts
R that show remaining hydraulic fluid varnish or
R baked-on hydraulic fluid.

R 2. Use the applicable AMM maintenance task
R instructions to clean the parts that show
R remaining hydraulic fluid varnish or baked-on
R hydraulic fluid.

R 3. After the parts are clean, do a visual
R inspection of the parts. Use the applicable
R AMM maintenance task for the inspection limits.

R (f) If inspection finds part surfaces with baked-on
R or burned hydraulic fluid and/or engine gaspath
R surfaces with contamination from hydraulic fluid,
R then do the subsequent procedure:

R 1. Do not operate the engine if engine gaspath
R surfaces have contamination from hydraulic
R fluid.

R 2. Disassemble the engine to remove those gaspath
R parts on which the visual/borescope inspection
R found contamination from hydraulic fluid.

R a. If you or some other operator did a gaspath
R wash after the contamination of engine
R gaspath surfaces from hydraulic fluid
R occurred, then it is necessary to remove and
R clean all parts in the engine gaspath.

R 3. Use the applicable AMM maintenance task
R instructions to clean the parts.

R 4. After the parts are clean, do a visual
R inspection of all parts that had contamination
R from hydraulic fluid. Use the applicable AMM
R maintenance task for the inspection limits.

R G. Cleaning After an Oil or Fuel Leak

R (1) After an oil or fuel leak, do the subsequent procedure:

R (a) Do an external wash to remove the oil or fuel from
R the external surfaces of the engine. Do the
R subsequent steps:

R 1. Use Cleaning of Electrical Harnesses and
R Contact Points (SPOP 6) to clean electrical
R harnesses and contact points. Refer to
R 70-00-00, Cleaning/Painting-20 (Task
R 70-00-00-100-020.

R 2. Use one of the procedures in the subsequent
R list to clean other external surfaces:

R a. Use Cleaning the Exterior of the Engine
R (SPOP 1) to clean other external surfaces.
R Refer to 70-00-00, Cleaning/Painting-02
R (Task 70-00-00-100-002).

R b. Use Degrease Engine Parts by Solvent
R Wipe (SPOP 208) to remove grease from
R other external surfaces. Refer to
R 70-00-00, Cleaning/Painting-04 (Task
R 70-00-00-100-004).

R (b) Do an internal (gaspath) wash of the engine to
R remove the oil or fuel from the engine gaspath
R surfaces. Refer to the applicable AMM maintenance
R task for the gaspath wash procedure.

FIRE EXTINGUISHER AGENT TYPE	VISUAL/ BORESCOPE INSPECTION	EXTERNAL WASH	INTERNAL WASH	DISASSEMBLE/ CLEAN BY ENGINE MANUAL
WATER				
WATER	N/R	N/R	N/R	N/R
WATER FOG	N/R	N/R	N/R	N/R
GASEOUS				
ANSUL INERGEN® (N_2 + Ar + CO_2)	N/R	N/R	N/R	N/R
CARBON DIOXIDE	N/R	N/R	N/R	N/R
NITROGEN	N/R	N/R	N/R	N/R
SULFUR HEXAFLUORIDE (SF_6)	N/R	NO	NO	YES
VAPORIZING LIQUID				
DUPONT FE-232™ (HCFC-123)	N/R	NO	NO	YES
DUPONT FE-36™ (HFC-236fa)	N/R	NO	NO	YES
DUPONT FE-227™ /FM-200® (HFC-227 ea)	N/R	NO	NO	YES
GREAT LAKES FM-100 (HBFC-22B1)	N/R	N/R	N/R	N/R
HALON 1011 (HBCC-30B1)	N/R	NO	NO	YES
HALON 1202 (BFC-12B2)	N/R	NO	NO	YES
HALON 1211 (BCFC-12B1)	N/R	NO	NO	YES
HALON 1301 (BFC-13B1) - NACELLE DISCHARGE/RELEASE	N/R	N/R	N/R	N/R
HALON 1301 (BFC-13B1) - IN PRIMARY GASPATH	N/R	NO	NO	YES
HALON 2402 (BFC-114B2)	N/R	NO	NO	YES
HALOTRON® I (HCFC-123 BLEND)	N/R	NO	NO	YES
HALOTRON® II (HFC-134a + HFC-125 + CO_2)	N/R	NO	NO	YES
DRY CHEMICAL				
NFPA ABC MULTI-CLASS:				
AMMONIUM PHOSPHATE	YES	NO	NO	YES
NFPA BC MULTI-CLASS:				
PURPLE K	YES	NO	NO	YES
SODIUM BICARBONATE	YES	NO	NO	YES
NFPA CLASS D:				
FOUNDRY FLUX	YES	NO	NO	YES
ANSUL MET-L-X®	YES	NO	NO	YES
FYR-FYTER METAL FYR	YES	NO	NO	YES
M-1	YES	NO	NO	YES
PYRO-CHEM® G-1	YES	NO	NO	YES
Refer to the text for the full requirements.				

G-06181 (0209)
PW V

Cleaning Requirements After Chemical Contact With Fire Extinguishing Agents, Hydraulic Fluid, Oil, or Fuel (SPOP 425)
Figure 701 (Sheet 1)
(Task 70-00-00-100-001)

FIRE EXTINGUISHER AGENT TYPE	VISUAL/ BORESCOPE INSPECTION	EXTERNAL WASH	INTERNAL WASH	DISASSEMBLE/ CLEAN BY ENGINE MANUAL
FOAM				
AQUEOUS FILM-FORMING FOAMS (AFFF):				
ANSULITE® 1%	N/R	N/R	N/R	N/R
ANSULITE® 3% (AFC-3A)	N/R	N/R	N/R	N/R
ANSULITE® PREMIUM 3% (AFC-5-A)	N/R	N/R	N/R	N/R
CHEMGUARD 3% AFFF C-303	N/R	N/R	N/R	N/R
ALL OTHER AQUEOUS FILM-FORMING FOAMS	YES	NO	NO	YES
HIGH EXPANSION FOAMS				
ANSUL JET-X® 2 3/4%	N/R	N/R	N/R	N/R
NATIONAL FOAM HI-EX® 2%	N/R	N/R	N/R	N/R
ALL OTHER HIGH EXPANSION FOAMS	YES	NO	NO	YES
OTHER FOAM TYPES:				
PROTEIN (P, FP, OR FFFP)	YES	NO	NO	YES
SODA-ACID	YES	NO	NO	YES
TRIMETHOXYBOROXINE (TMB)	YES	NO	NO	YES
WATER-GLYCOL	YES	NO	NO	YES
Refer to the text for the full requirements				

G-12743 (0209)
PW V

Cleaning Requirements After
Chemical Contact With Fire
Extinguishing Agents, Hydraulic
Fluid, Oil, or Fuel (SPOP 425)
Figure 701 (Sheet 2)
(Task 70-00-00-100-001)

Task 70-00-00-100-002:

1. Cleaning Exterior Of Engine (SPOP 1)

A. Effectivity

(1) All (727/8D, 737/8D, Super 27/8D, DC-9/8D)

B. General

WARNING: REFER TO THE MANUFACTURER'S MATERIAL SAFETY DATA SHEETS FOR CONSUMABLE MATERIAL'S INFORMATION SUCH AS: HAZARDOUS INGREDIENTS, PHYSICAL/CHEMICAL CHARACTERISTICS, FIRE, EXPLOSION, REACTIVITY, HEALTH HAZARD DATA, PRECAUTIONS FOR SAFE HANDLING, USE AND CONTROL MEASURES.

(1) This task gives the general instructions for the cleaning of the exterior of the engine.

(2) This procedure removes oils, grease, hydraulic fluid, and loose soil from engine exterior surfaces (that is, the outer surfaces of the engine) or external parts, which decreases the time necessary to clean
R disassembled QEC (Quick Engine Change) parts.

(3) This procedure does not remove hard, baked-on carbon.

C. Consumable Materials

(1) For Assembled Engines

NOTE: The P-numbers shown in this list are used by other Pratt & Whitney engine programs and are included to keep this list common with those used by other engine and airframe programs.

(a) METHOD A

1 Spray, Steam, or Foam Cleaners

(P11-031) Alkali Cleaner (PMC 1284)
(P11-040) Alkali Cleaner (SPMC 106)
(P11-044) Alkali Cleaner (SPMC 104)
(P11-045) Alkali Cleaner (SPMC 105)
(P11-071) Aqueous Cleaner (SPMC 113)
(P11-072) Aqueous Degreaser (SPMC 151)
(P11-073) Aqueous Degreaser (SPMC 195)
(P11-079) Aqueous Degreaser (SPMC 170)
(P11-080) Aqueous Degreaser (SPMC 181)

(CONTINUED)

(P11-081) Aqueous Cleaner (SPMC 207)
(P11-082) Aqueous Degreaser (SPMC 173)
R (P11-083) Aqueous Cleaner (SPMC 173)

2 Gel-type Cleaners

(P11-047) Alkaline Gel Cleaner (SPMC 109)
(P11-048) Alkaline Gel Cleaner (SPMC 110)
(P11-069) Alkaline Gel Cleaner (SPMC 112)
(P11-070) Alkaline Gel Cleaner (SPMC 159)

(b) METHOD B

1 (P05-421) Scrub Pad (PMC 4095)

2 (P05-422) Scrub Pad (PMC 4435)

3 Spray or Wipe Cleaners

(P11-049) Aqueous Cleaner (SPMC 148-1 thru SPMC 148-4)

(2) For Disassembled Engines

NOTE: Refer to METHOD A or METHOD B above or use the subsequent consumable material.

(a) Cleaner Applied by Brush

(P11-027) Stoddard Solvent (PMC 9001)

D. Procedure to Remove Grease From the Exterior Surfaces of the Engine by METHOD A or METHOD B

(1) METHOD A

(a) Install covers on all openings into the engine (this includes the inlet, exhaust, all bleeds, open fuel lines, open oil lines, breather tubes, and open electrical connectors).

(b) Clean by one of the subsequent procedures:

NOTE: Service experience shows that the gel-type cleaners are more effective than the spray, steam, and foam solutions on very dirty engines because the gel cleaners stay on the engine better than the spray, steam, and foam solutions, which drain off the engine during the soak time.

R 1. Mix one of these materials with water to make a
R cleaner solution at a concentration that is
R equal to or less than the maximum specified
R concentration, then apply this solution as a
R spray, steam, or foam:

Specification	Name	Maximum Concentration (Mixed with Water)
(P11-031)	Alkali Cleaner (PMC 1284)	30% by volume
(P11-040)	Alkali Cleaner (SPMC 106)	30% by volume
(P11-044)	Alkali Cleaner (SPMC 104)	25% by volume
(P11-045)	Alkali Cleaner (SPMC 105)	25% by volume
(P11-071)	Aqueous Cleaner (SPMC 113)	20% by volume
(P11-072)	Aqueous Degreaser (SPMC 151)	25% by volume
(P11-073)	Aqueous Degreaser (SPMC 195)	50% by volume
(P11-079)	Aqueous Degreaser (SPMC 170)	20% by volume
(P11-080)	Aqueous	25% by

	Specification	Name	Maximum Concentration (Mixed with Water)
(CONTINUED)			
		Degreaser (SPMC 181)	volume
	(P11-081)	Aqueous Cleaner (SPMC 207)	30% by volume
	(P11-082)	Aqueous Degreaser (SPMC 173)	25% by volume
R R	(P11-083)	Aqueous Cleaner (SPMC 233)	20% by volume

2 Spray on one of the subsequent gel-type cleaners. Do not use a steam machine to apply the gel-type cleaner.

NOTE: It is necessary to use a special applicator to apply the gel-type cleaners. Refer to the gel manufacturer's instructions for the correct applicator.

Specification	Name	Concentration
(P11-047)	Alkaline Gel Cleaner (SPMC 109)	As received
(P11-048)	Alkaline Gel Cleaner (SPMC 110)	As received
(P11-069)	Alkaline Gel Cleaner (SPMC 112)	As received
(P11-070)	Alkaline Gel Cleaner (SPMC 159)	As received

(c) Let the cleaner solution or gel-type cleaner stay on the engine for 10 - 20 minutes.

(d) Flush the engine fully with warm or hot water, or with steam.

(e) Remove the covers from all the openings on the engine.

R (2) METHOD B (Local Application Only). Use one of these
R procedures:

R (a) Apply (P11-049) aqueous cleaner (SPMC 148-1 thru
R SPMC 148-4), as received. If necessary, scrub
R with a soft brush (non-metallic), a (P05-421)
R scrub pad (PMC 4095), or a (P05-422) scrub pad
R (PMC 4435) to clean the engine.

WARNING: SPOP 208 SOLVENTS ARE FLAMMABLE. IF YOU USE SPOP 208 SOLVENTS ON HOT ENGINE PARTS, THERE WILL BE AN INCREASED RISK OF FIRE.

(b) Use a brush (not made of metal), a (P05-421) scrub pad (PMC 4095), (P05-422) scrub pad (PMC 4435), or a clean cloth to apply a solvent from SPOP 208 (Ref. Task 70-00-00-100-004). Wipe dry with a clean cloth.

1 If engine parts are hot, let the temperature of the parts decrease to a temperature at which you can touch the parts without gloves, and then apply the SPOP 208 solvent (Ref. Task 70-00-00-100-004).

E. Procedure to Clean the Engine External Component Parts After Removal of the Parts From the Engine

(1) When it is necessary to clean engine external component parts after removal of the parts from the engine, do one of the subsequent procedures to clean the parts:

(a) Do Method A above.

(b) Do Method B above.

(c) Do the subsequent procedure:

1. Apply (P11-027) Stoddard Solvent (PMC 9001) to the parts with a brush in a solvent-recirculating parts washer or washer/soak tank that uses a recirculating pump to supply filtered solvent to the brush through a flexible supply hose.

2. Wipe the parts dry with a clean cloth.

Task 70-00-00-100-003:

1. Degrease Parts by Aqueous Cleaner (No Rinse) (SPOP 209)

A. Effectivity

(1) All (727/8D, 737/8D, Super 27/8D, DC-9/8D)

B. General

(1) This task gives the necessary instructions for the
R cleaning of the engine external parts with PWA 77 and
R PWA 110 (PWA 595) coatings. This task is not for
R bearings.

C. Consumable Materials

NOTE: The P- numbers shown in this list are used by other Pratt & Whitney engine programs and are included to keep this list common with those in other engine and airframe programs.

(1) (P05-005) Lint Free Cotton Cloth

(2) (P11-049) Aqueous Cleaner (SPMC 148)

D. Procedure - Degreasing of Parts by Aqueous Cleaning (Aqueous
R Spray or Wipe Without Rinse)

R WARNING: REFER TO THE MANUFACTURER'S MATERIAL SAFETY DATA SHEETS FOR CONSUMABLE MATERIAL'S INFORMATION SUCH AS: HAZARDOUS INGREDIENTS, PHYSICAL/CHEMICAL CHARACTERISTICS, FIRE, EXPLOSION, REACTIVITY, HEALTH HAZARD DATA, PRECAUTIONS FOR SAFE HANDLING, USE AND CONTROL MEASURES.

(1) Always obey the specific procedures and limits in the specific AMM maintenance tasks.

R (2) Remove light oils, grease, fingerprints, dust, and soot
R from engine external parts by the subsequent steps:

R CAUTION: PARTS COATED WITH PWA 77 DIFFUSED ALUMINIDE CAN BE CLEANED ONLY WITH SPOP 209 AQUEOUS DEGREASING. THE USE OF OTHER ALKALINE CLEANERS WILL CAUSE

DETERIORATION OR REMOVAL OF THIS COATING.

R CAUTION: PARTS COATED WITH PWA 110 (PWA 595) ALUMINUM COATING CAN BE CLEANED ONLY WITH SPOP 209. THE USE OF OTHER ALKALINE CLEANERS WILL CAUSE DETERIORATION OR REMOVAL OF THIS COATING.

R (a) Degrease the part by one of the subsequent steps:

R 1. Wipe the part with a clean (P05-005) Lint Free Cotton Cloth wet with (P11-049) Aqueous Cleaner (SPMC 148).

R a. Use the aqueous cleaner as received.

R b. Do not dilute the aqueous cleaner or make a solution.

R c. Pour the solvent onto the cloth to keep
R unwanted material from the wiping solvent.

R d. Do not dip the cloth into the solvent container.

R 2. Spray the (P11-049) Aqueous Cleaner (SPMC 148)
R on the part.

R (b) If necessary, scrub the part with a soft non-metallic brush or pad.

R (c) Wipe the part dry with a clean (P05-005) Lint Free Cotton Cloth.

Task 70-00-00-100-004:

1. Degrease Engine Parts by Solvent Wipe (SPOP 208)

A. Effectivity

(1) All (727/8D, 737/8D, Super 27/8D, DC-9/8D)

B. General

(1) This task gives the general instructions and the approved materials for degreasing of the engine parts by wiping.

C. Consumable Materials

NOTE: The P- numbers in this list are used by other Pratt & Whitney engine programs and are included to keep this list common with those in other engine and airframe programs.

(1) (P05-005) Lint Free Cotton Cloth

(2) (P11-005) Methyl Ethyl Ketone Solvent (Technical Grade) (PMC 9076)

(3) (P11-005A) Methyl Ethyl Ketone Solvent (Reagent Grade) (PMC 1820)

(4) (P11-014) Isopropyl Alcohol (Technical Grade) (PMC 9094)

(5) (P11-014A) Isopropyl Alcohol (Reagent Grade) (PMC 9016)

(6) (P11-032) Acetone (Phenol-free) (PMC 9008)

(7) (P11-038) Cleaner Solvent (PMC 8904)

(8) (P11-039) Cleaner Solvent (PMC 9060)

(9) (P11-042) Cleaner Remover (PMC 4366)

(10) (P11-055) Cleaner Solvent (PMC 8914)

(11) (P11-056) Cleaner Solvent (SPMC 156)

(12) (P11-057) Cleaner Solvent (SPMC 168)

(13) (P11-058) Cleaner Solvent (SPMC 175)

R
R

(14) (P11-059) Cleaner Solvent (SPMC 176)

(15) (P11-062) Dielectric Solvent (PMC 8920)

(16) (P11-063) Hand-Wiping Solvent (PMC 8917)

(17) (P11-064) Cleaner Solvent (SPMC 185)

(18) (P11-065) Acetone (Reagent Grade) (PMC 1914)

(19) (P11-066) Hand-Wiping Solvent (PMC 8929)

(20) (P11-067) Cleaner Solvent (SPMC 169)

(21) (P11-074) Cleaner Solvent (SPMC 213-1)

(22) (P11-075) Cleaner Solvent Wipe (SPMC 213-2)

(23) (P11-076) Cleaner Solvent (SPMC 216-1)

(24) (P11-077) Cleaner Solvent Wipe (SPMC 216-2)

D. Procedure - General Instructions

R **WARNING**: REFER TO THE MANUFACTURER'S MATERIAL SAFETY
R DATA SHEETS FOR CONSUMABLE MATERIAL'S
R INFORMATION SUCH AS: HAZARDOUS INGREDIENTS,
R PHYSICAL/CHEMICAL CHARACTERISTICS, FIRE,
R EXPLOSION, REACTIVITY, HEALTH HAZARD DATA,
R PRECAUTIONS FOR SAFE HANDLING, USE AND
R CONTROL MEASURES.

(1) Always obey the specific procedures and limits in the specific AMM maintenance tasks.

CAUTION: DO NOT IMMERSE IN SOLVENTS THOSE PART ASSEMBLIES THAT HAVE PARTS THAT ARE NOT METALLIC.

(2) This SPOP 208 procedure is for use on titanium and non-titanium parts.

R **CAUTION**: SIZED CHEESECLOTH CONTAINS RESIN BINDERS
R THAT CAN DISSOLVE IN SOLVENTS AND CAUSE
R CONTAMINATION OF BOND SURFACES AND PREVENT A
R GOOD ADHESIVE BOND.

R (3) Do not use sized cheesecloth with solvents.

R (4) Methanol or halogenated hydrocarbon solvents are not
R permitted in SPOP 208.

E. Procedure - Degrease Engine Parts by Solvent Wipe

R WARNING: THE SOLVENTS IN THIS PROCEDURE ARE FLAMMABLE.

R CAUTION: DO NOT PUT PARTS THAT CONTAIN MATERIALS THAT
R ARE NOT METALLIC FULLY IN SOLVENTS.

R CAUTION: DO NOT DIP (PUT MOMENTARILY) THE WIPING
R CLOTH IN THE SOLVENT CONTAINER (THIS CAN
R CAUSE CONTAMINATION OF THE SOLVENT, WHICH
R CAN CAUSE CONTAMINATION OF THE PART SURFACES
R AND PREVENT A GOOD BOND WITH ADHESIVES OR
R PAINTS).

R (1) Wipe the part with an unsized, clean, white (P05-005)
R Lint Free Cotton Cloth wet with one of these applicable
R solvents:

R NOTE: Be sure to use clean cotton gloves to touch
R clean parts before adhesive bonding.

R (a) See Figure 701 for descriptions and letter codes
R of solvents approved to use on metallic or
R non-metallic parts.

R (b) See Figure 702 for the solvents that are approved
R to remove grease from metallic parts for general
R wiping, for local fluorescent penetrant inspection
R (FPI), or before adhesive bonding or painting.

R (c) See Figure 703 for the solvents that are approved
R to remove grease from non-metallic parts for
R general wipe cleaning, or before painting or
R adhesive bonding.

R (2) Air dry the parts.

(a) Do not use compressed air to dry parts before
R adhesive bonding or painting. Compressed air can
R contain oil vapors.

LETTER CODE	MATERIAL NO.	DESCRIPTION	FLASHPOINT	VAPOR PRESSURE
A	P11-005A	METHYL ETHYL KETONE (REAGENT GRADE)	<140°F (60°C)	>45mm Hg
B	P11-065	ACETONE (REAGENT GRADE)	<140°F (60°C)	>45mm Hg
C	P11-042	FLUORESCENT PENETRANT CLEANER/REMOVER	<140°F (60°C)	>45mm Hg
D	P11-055	SOLVENT CLEANER	≥ 140°F (60°C)	≤ 45mm Hg
E	P11-063	HAND-WIPING SOLVENT	≥ 140°F (60°C)	≤ 45mm Hg
F	P11-062	DIELECTRIC SOLVENT	≥ 140°F (60°C)	≤ 45mm Hg
G	P11-066	HAND-WIPING SOLVENT	<140°F (60°C)	≤ 45mm Hg
H	P11-032	ACETONE (TECHNICAL GRADE)	<140°F (60°C)	>45mm Hg
I	P11-014A	ISOPROPYL ALCOHOL (REAGENT GRADE)	<140°F (60°C)	≤ 45mm Hg
J	P11-039	SOLVENT CLEANER	<140°F (60°C)	>45mm Hg
K	P11-005	METHYL ETHYL KEYTONE (TECHNICAL GRADE)	<140°F (60°C)	>45mm Hg
L	P11-014	ISOPROPYL ALCOHOL (TECHNICAL GRADE)	<140°F (60°C)	≤ 45mm Hg
M	P11-056	CLEANER SOLVENT	≥ 140°F (60°C)	≤ 45mm Hg
N	P11-057	CLEANER SOLVENT	≥ 140°F (60°C)	≤45mm Hg
O	P11-067	CLEANER SOLVENT	≥ 140°F (60°C)	≤ 45mm Hg
P	P11-058	CLEANER SOLVENT	<140°F (60°C)	≤ 45mm Hg
Q	P11-059	CLEANER SOLVENT	<140°F (60°C)	≤ 45mm Hg
R	P11-064	CLEANER SOLVENT	≥ 140°F (60°C)	≤ 45mm Hg
S	P11-074	CLEANER SOLVENT	<140°F (60°C)	≤ 45mm Hg
T	P11-075	CLEANER SOLVENT WIPES	<140°F (60°C)	≤ 45mm Hg
U	P11-076	CLEANER SOLVENT	<140°F (60°C)	≤ 45mm Hg
V	P11-077	CLEANER SOLVENT WIPES	<140°F (60°C)	≤ 45mm Hg

G-12605 (0807)
PW V

Descriptions And Letter Codes
Of Solvents Approved To Use On
Metallic Or Non-Metallic Parts
Figure 701
(Task 70-00-00-100-004)

APPLICATION	SOLVENTS APPROVED TO DEGREASE METALLIC PARTS *
FPI (LOCAL)	A B C G H I J K L P Q S T
GENERAL WIPE	A B C D E F G H I J K L M N O P Q R S T U V
PRE-ADHESIVE BONDING	A B C G I J P Q S T
PRE-PAINTING	A B C G I J P Q S T U V

* SEE FIGURE 701 FOR SOLVENT LETTER CODES.

G-12608 (0807)
PW V

Solvents Approved To
Use On Metallic Parts
Figure 702
(Task 70-00-00-100-004)

SPEC. NO.	NON-METALLIC PART DESCRIPTION OF MATERIAL	SOLVENTS APPROVED TO DEGREASE NON-METALLIC PARTS *
PWA 410	FIBERGLASS STRUCTURES, LAMINATED MOLDINGS	A B C G H I J K L P Q
PWA 411	CLOTH, GLASS, EPOXY RESIN IMPREGNATED	A B C G H I J K L P Q
PWA 446	POLYURETHAN RESIN, FOAMING	I
PWA 459	FABRIC, AROMATIC POLYAMIDE, EPOXY RESIN IMPREGNATED	A B C G H I J K L P Q
PWA 460	LAMINATED STRUCTURES, AROMATIC POLYAMIDE FABRIC - EPOXY RESIN MATRIX	A B C G H I J K L P Q
PWA 479	MOLDING COMPOUND, POLYAMIDE, COMPOSITE	B I
PWA 628	FOAM, MOLDED POLYURETHANE	I
PWA 36013	POLYURETHANE COATING, CONDUCTIVE, BLACK	I
PWA 36014	POLYURETHANE SURFACER, WHITE	I
PWA 36151	COMPOSITE AIRFOILS, CARBON FIBER REINFORCED	A B C G H I J K L P Q
PWA 36408	FABRIC, CARBON FIBER AND FIBERGLASS, POLYIMIDE RESIN IMPREGNATED	B I
PWA 36414	FABRIC, ALUMINUM BOROSILICATE GLASS FIBER, EPOXY RESIN IMPREGNATED	B I
PWA 36422	FABRIC, FIBERGLASS, EPOXY RESIN IMPREGNATED	A B C G H I J K L P Q
PWA 36426	MOLDING COMPOUND, POLYETHERIMIDE COMPOSITE	B
PWA 36442	FLUOROELASTOMER SHEET	I
PWA 36509	PRIMER, POLYURETHANE	I
PWA 36510	COATING, POLYURETHANE, EROSION RESISTANT	I
PWA 36516	FLUOROELASTOMER COATING	I
*SEE FIGURE 701 FOR THE SOLVENT LETTER CODES.		

G-12609 (0607)
PW V

Solvents Approved For
Non-Metallic Parts
Figure 703
(Task 70-00-00-100-004)

Task 70-00-00-100-005:

1. Local Removal of Carbon from Tubes by Alkaline Gel (SPOP 2)

A. Effectivity

(1) All (727/8D, 737/8D, Super 27/8D, DC-9/8D)

B. General

(1) This task gives the necessary instructions for the cleaning of coke from removed engine parts.

C. Consumable Materials

NOTE: The P- numbers shown in this list are used by other Pratt & Whitey engine programs and are included to keep this list common with those in other engine and airframe programs.

(1) (P11-053) Alkaline Gel Cleaner (SPMC 135), (SPMC 136), (SPMC 137)

D. Procedure - General Instructions

NOTE: This SPOP is approved to use on magnesium, steel, nickel, cobalt, and titanium.

WARNING: REFER TO THE MANUFACTURER'S MATERIAL SAFETY DATA SHEETS FOR CONSUMABLE MATERIAL'S INFORMATION SUCH AS: HAZARDOUS INGREDIENTS, PHYSICAL/CHEMICAL CHARACTERISTICS, FIRE, EXPLOSION, REACTIVITY, HEALTH HAZARD DATA, PRECAUTIONS FOR SAFE HANDLING, USE AND CONTROL MEASURES.

CAUTION: DO NOT USE THIS SPOP ON ALUMINUM, CARBON SEALS, OR BEARINGS. DO NOT USE THIS SPOP ON TUBES WITH ALUMINUM FITTINGS. DO NOT IMMERSE INSULATED TUBES. IF YOU DO, DAMAGE TO THE PARTS CAN OCCUR.

CAUTION: DO NOT USE A WIRE BRUSH. WIRE BRUSHES CAN CAUSE SCRATCHES THAT ROUGHEN THE SURFACE AND INCREASE THE POSSIBILITY OF COKE FORMATION. THESE SCRATCHES CAN ALSO CAUSE CRACKS TO FORM WHICH CAN RESULT IN FAILURE OF THE TUBE.

(1) Always obey the specific procedures and limits in the specific AMM maintenance tasks.

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(2) Do not use this SPOP 2 on any parts made of aluminum, on carbon seals, or on bearings.

(3) Do not immerse tubes with insulation or heatshields in the gel.

(4) Do not use a wire brush.

E. Procedure - Remove Carbon by Alkaline Gel

(1) Remove and mask or plug the part as necessary.

(2) Apply the (P11-053) Alkaline Gel Cleaner (SPMC 135), (SPMC 136), or (SPMC 137) to the part at ambient temperature.

NOTE: Do not dilute. Do not make a solution.

R (3) For carbon removal from tubes, pump or pour the cleaner
R into the tubes for soak.

R (4) Soak the part by one of these methods:

R (a) Soak the part for 10 minutes to 12 hours.

R (b) For more effective removal of heavy carbon, soak
R the part in two-hour increments. Then flush with
R water and apply the alkaline gel again.

(5) Flush fully with cold or hot water pressure spray.

(6) Remove masking or plugs.

(7) Do an inspection for the removal of carbon with a borescope if used to clean the inner diameter of a tube or external cavity.

(a) If necessary, do the procedure again.

(b) Maximum soak time is 24 hours.

Task 70-00-00-990-010:

R 1. Potable Water Quality Specifications For Compressor Wash Or
R Detergent Cleaning Procedures On-Wing

R NOTE: Potable water is specified in Maintenance Manuals for
R rinse water after engine detergent washing is done.

A. Effectivity

(1) All (727/8D, 737/8D, Super 27/8D, DC-9/8D)

B. General

(1) This task gives the general instructions to determine if water is potable for use during engine gaspath cleaning.

C. General - Potable Water Quality Specifications (Compressor Wash)

(1) The quality specifications for potable water suitable for engine gaspath cleaning are as follows:

R R Physical	Maximum Permitted Levels
Color	15 units
pH	6.4 - 8.5
Temperature	75°F (24° C)
Total Dissolved Solids	500 mg/l
Threshold Odor Number	2
Turbidity	5 units

Inorganic	Milligrams/Liter
Arsenic	0.05
Barium	1.
Cadmium	0.01
Chlorides	250
Chromium	0.05
Copper	1.0
Cyanide	0.2
Fluoride	2.0

Inorganic	Milligrams/Liter
Iron	0.3
Lead	0.05
Magnesium	125
Manganese	0.05
Mercury	0.002
Nitrite Nitrogen	1.0 (as N)
Nitrite plus Nitrate Nitrogen	10.0 (as N)
Selenium	0.01
Silver	0.05
Sodium	20
Sulfate	250
Zinc	5.0

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Task 70-00-00-100-011:

1. Preparation of Gaspath/Compressor Cleaner, Solution

A. Effectivity

(1) All (727/8D, 737/8D, Super 27/8D, DC-9/8D)

B. References

(1) Task 70-00-00-990-010 Potable Water Quality Specifications (Compressor Wash)

C. Consumable Materials

NOTE: The P- numbers shown in this list are used by other Pratt & Whitney engine programs and are included to keep this list common with those in other engine and airframe programs.

R (1) (P11-021) Gas Path Solvent Cleaner (SPMC 87-4)

R (2) (P11-021) Gas Path Solvent Cleaner (SPMC 87-5)

R (3) (P11-021) Gas Path Solvent Cleaner (SPMC 87-6)

R (4) (P11-021) Gas Path Solvent Cleaner (SPMC 87-7)

R (5) (P11-021) Gas Path Detergent Cleaner (SPMC 87-9A)

R (6) (P11-021) Gas Path Detergent Cleaner (SPMC 87-9B)

R (7) (P11-021) Gas Path Detergent Cleaner (SPMC 87-10A)

R (8) (P11-021) Gas Path Detergent Cleaner (SPMC 87-10B)

R (9) (P11-021) Gas Path Detergent Cleaner (SPMC 87-11A)

R (10) (P11-021) Gas Path Detergent Cleaner (SPMC 87-11B)

R (11) (P11-021) Gas Path Detergent Cleaner (SPMC 87-11C)

R (12) (P11-021) Gas Path Detergent Cleaner (SPMC 87-12)

R (13) (P11-021) Gas Path Detergent Cleaner (SPMC 87-13)

R (14) (P11-021) Gas Path Detergent Cleaner (SPMC 87-14)

D. Procedure - General Instructions

(1) Always obey the procedures and limits in the applicable AMM maintenance tasks.

(2) Refer to Potable Water Quality Specification (Task 70-00-00-990-010) for potable water specifications.

(3) Mix as specified in the applicable gaspath/compressor cleaning cart.

R R NOTE: SPMC 87-1 thru -3 and 8 are no longer available and there are no replacements.

R (a) SPMC 87-4, -6, -7, -10A, -12, -13, or -14 at 20 percent by volume with potable water.

(b) SPMC 87-5, -9A, -10B, or -11B at 100 percent by volume.

(c) SPMC 87-9B at 15 percent by volume with potable water.

(d) SPMC 87-11A at 10 percent by volume with potable water.

(e) SPMC 87-11C at 20 percent by volume with potable water.

Task 70-00-00-100-020:

1. Cleaning of Electrical Wiring Harnesses and Contact Points (SPOP 6)

A. Effectivity

(1) All (727/8D, 737/8D, Super 27/8D, DC-9/8D)

B. General

(1) This task gives the general instructions and the approved materials for cleaning of electrical wiring harnesses and contact points.

C. References

(1) Task 70-00-00-400-022 Enhancement of Electrical Connector Contacts (SPOP 430)

D. Consumable Materials

NOTE: The P- numbers in this list are used by other Pratt & Whitney engine programs and are included to keep this list common with those in other engine and airframe programs.

(1) (P05-005) Lint Free Cotton Cloth

(2) (P11-014A) Reagent Grade Isopropyl Alcohol (PMC 9016)

(3) (P11-055) Cleaner Solvent (PMC 8914)

(4) (P11-056) Cleaner Solvent (SPMC 156)

(5) (P11-057) Cleaner Solvent (SPMC 168)

(6) (P11-058) Cleaner Solvent (SPMC 175)

(7) (P11-059) Cleaner Solvent (SPMC 176)

(8) (P11-060) Cleaner Solvent (SPMC 179)

(9) (P11-062) Ultra High Purity Dielectric Solvent (PMC 8920)

R (10) (P11-064) Cleaner Solvent (SPMC 185)

E. Procedure - Cleaning Instructions

(1) Always obey the specific procedures and limits in the specific AMM maintenance tasks.

R (2) Spray one of these materials on the harnesses and the
R connector contacts.

(a) (P11-014A) Reagent Grade Isopropyl Alcohol (PMC 9016)

(b) (P11-055) Cleaner Solvent (PMC 8914)

(c) (P11-056) Cleaner Solvent (SPMC 156)

(d) (P11-057) Cleaner Solvent (SPMC 168)

(e) (P11-058) Cleaner Solvent (SPMC 175)

(f) (P11-059) Cleaner Solvent (SPMC 176)

(g) (P11-060) Cleaner Solvent (SPMC 179)

(h) (P11-062) Ultra High Purity Dielectric Solvent (PMC 8920).

R (i) (P11-064) Cleaner Solvent (SPMC 185)

(3) Wipe clean the area with a (P05-005) Lint Free Cotton Cloth.

(4) Let the connector dry or blow dry with clean air at 30 psi (206.8 kPa).

(5) If necessary, you can use a contact enhancer. Refer to Enhancement of Electrical Connector Contacts (SPOP 430) (Task 70-00-00-400-022).

NOTE: Refer to SPOP 430 for when and why you use the Enhancer.

Task 70-00-00-300-001:

R 1. Denicking (Blending) and Buffing/Polishing of Titanium Parts
R (SPOP 532)

A. Effectivity

(1) All (727/8D, 737/8D, Super 27/8D, DC-9/8D)

B. General

(1) This task gives the general instructions for blending and buffing of titanium parts.

C. References

(1) Task 70-00-00-230-001, Fluorescent Penetrant Inspection (Local Application) (SPOP 70)

D. Equipment

(1) No Specific) Pneumatic Hand Tool

(2) (No Specific) Tampico Brush

(3) (No Specific) Files

(4) (No Specific) Abrasive Stone

(5) (No Specific) Abrasive Paper

(6) (No Specific) Crocus Cloth

(7) (No Specific) Abrasive Pads

(8) (No Specific) Emery Cloth

(9) (No Specific) Silicon Carbide or Aluminum Oxide Grit (80, 120, or 180 mesh)

E. Consumable Materials

NOTE: The P-numbers shown in this list are used in other Pratt & Whitney engine programs and are included to keep this list common with those in other engine and airframs programs.

R (1) (P05-066) Buffing/Polishing Compound (PMC 3061)

(2) (P05-353) Cloth Wheel (Non-Coated)

(3) (P05-354) Polishing Compound (PMC 3017)

(4) (P05-384) Silicon Carbide Deburring Compound (PMC 3088)

R (5) (P05-421) Scrub Pad (PMC 4095)

R (6) (P05-422) Scrub Pad (PMC 4035)

R (7) (P05-426) Polishing Compound (PMC 3022)

R (8) (P05-427) Polishing Compound (PMC 3023)

F. Procedure - General Denicking and Buffing Instructions

WARNING: TITANIUM DUST CAN BE A FIRE HAZARD. BE SURE TO FREQUENTLY REMOVE BLEND DUST FROM THE PART, BLEND REPAIR AREA, AND GLOVES USED DURING THE REPAIR.

CAUTION: LIMITS SPECIFIED IN THIS SECTION ARE FOR GENERAL USE ONLY. LIMITS SPECIFIED IN THE PART-SPECIFIC MANUALS TAKE PRECEDENCE. POST-BLEND SURFACE TREATMENT REQUIREMENTS WILL BE DETAILED WITHIN THE SPECIFIC BLEND REPAIR.

CAUTION: WHEN YOU DO THIS PROCEDURE, BE SURE TO USE GOOD SHOP PRACTICES AND COMMON SENSE. ABUSIVE BLENDING CAN CAUSE DAMAGE THAT IS HARMFUL TO THE LIFE AND FUNCTION OF THE REPAIRED PART.

CAUTION: TO CONTROL DUST AND NOISE CAUSED BY BLENDING, AND TO REDUCE THE RISK OF FIRE HAZARD FROM BLENDING DUST OF CERTAIN MATERIALS, WHENEVER POSSIBLE, DO THE BLENDING OPERATION IN A VENTILATED BOOTH. CONTACT YOUR LOCAL ENVIRONMENTAL HEALTH AND SAFETY PERSONNEL FOR SPECIFIC REQUIREMENTS.

CAUTION: USE ONLY MINIMUM PRESSURE WHEN YOU APPLY BLENDING TOOLS TO PARTS. EXCESSIVE PRESSURE AND SPEED WILL CAUSE SPARKS OR AN ORANGE-PEEL EFFECT THAT CAN POSSIBLY BE HARMFUL TO THE PART. KEEP MATERIAL TO A MINIMUM. DO NOT EXCEED BLEND LIMTS.

CAUTION: DO FREQUENT HEAT BUILDUP CHECKS. IF THE SURFACE IS TOO HOT TO TOUCH WITH YOUR HAND, LET THE PART BECOME COOLER BEFORE

YOU CONTINUE WITH THE REPAIR. OVERHEATING OF PARTS DURING BLEND REPAIR CAN CAUSE EMBRITTLEMENT.

CAUTION: DO NOT OVERHEAT THE PART BECAUSE DAMAGE CAN OCCUR.

CAUTION: BE SURE TO DRESS THE ABRASIVE TOOL BEFORE THE BLEND OPERATION TO KEEP TOOL OPERATION AT ITS BEST LEVEL AND TO KEEP MATERIAL CONTAMINATION FROM ONE PART REPAIR AWAY FROM SUBSEQUENT PART REPAIR.

CAUTION: USE A SHIELD OR MASK DURING REPAIR TO PROTECT OTHER SURFACES FROM DAMAGE BY ACCIDENTAL TOOL CONTACT DURING THE REPAIR.

(1) General Guidelines (Unless Specified Differently)

(a) Blending is an operation that is used to remove nicks, scratches, high metal, and other surface irregularities by intentional removal of base metal. Manual or mechanical methods are used to produce shallow and smooth surface depressions that reduce the stress concentration from the damaged area by the distribution of the stress concentration over larger, more tolerant areas.

(b) Before you start any blend repair, make sure that the part is crack-free. Refer to Fluorescent Penetrant Inspection (Local Application) (SPOP 70) (AMM TASK 70-00-00-230-001).

(c) Non-toleranced enclosed areas defined in blend repairs are to corners, points of tangency between surfaces, or at points opposite one of these locations. Enclosed areas will assume a tolerance of plus 0.125 inch (3.175 mm) in all directions unless adjacent areas are specified as areas where blending is not permitted.

(d) It is better to blend sharp impact damage that is within acceptable limits than it is to accept that damage. The sharper the impact, the better it is to blend the damaged area.

(e) It is recommended that you make one single blend when the adjacent damage is so close together that the minimum length-to-depth blend ratio cannot be done independently.

(f) The depth of the blend must be as deep as necessary to remove the damage with the repair limits specified.

(g) The best blends are the ones which are smooth, continuous, and round-bottomed that extend outboard from the damage area as much as necessary. Refer to the step that follows.

(h) For rotating parts, the length of the blend must be a minimum of 15 times the maximum depth of the blend in all directions. For non-rotating parts, the length of the blend must be a minimum of 10 times the maximum depth of the blend in all directions.

(i) Do a visual inspection of the blends.

(j) The surface finish of the blended area must be as smooth as, or smoother than, the initial surface. You can compare the surface finish with the adjacent non-blended surface.

(k) All transitions from blended to non-blended areas must be smooth and continuous.

(l) If the blended area intersects adjacent radii, the initial radius contour must be restored. Butterfly polish the holes if necessary.

(m) If the blended area intersects a corner, break the sharp edges 0.003 - 0.015 inch (0.08 - 0.38 mm).

(n) For local damage in the form of raised material, manual blending (that is, blending by hand) is the preferred method. Refer to the Manual Blending steps.

(o) When blending on a cylindrical surface, blend in the circumferential direction.

(p) Blend engine radial members in a radial direction.

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(q) For parts that are smaller than 1.75 inches (44.45 mm) in length, the Manual Blending procedure that follows is recommended.

(r) Manual Blending (Blending by Hand)

1 Manual blending is done with abrasive stones, abrasive paper, abrasive pads, files, emery cloth, and/or crocus cloth.

NOTE: Blending can be done with more than one grade of abrasive (coarse to fine, as necessary) to remove damage and get the specified surface finish. Be sure to start with the least aggressive abrasive needed to remove the damage.

(s) Mechanical Blending (Power Blending)

CAUTION: DO NOT OVERHEAT THE PART, OR DAMAGE CAN OCCUR.

1 When blending, use a power tool (electric or air) with abrasive-impregnated wheels, stones, and/or pads.

NOTE: Blending can be done with more than one grade of abrasive (coarse to fine, as necessary) to remove damage and get the specified surface finish. Be sure to start with the least aggressive abrasive needed to remove the damage.

2 Use minimum pressure when you apply the blending tool to the part to prevent heat build-up. Do not permit abrasive wheels to become loaded up with any particles remaining from blending.

(2) Buffing

(a) Buffing is an optional operation that you can use to get the necessary surface finish while blending.

1 Buff reworked area(s) with a power tool, a tampico brush, and Polishing (P05-066) Buffing Compound (PMC 3061) or (P05-384) Silicon Carbide Deburring Compound (PMC 3088).

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2 Use minimum pressure when you apply the buffing brush to the part to prevent heat build-up.

3 Buff engine radial members in a radial direction.

4 Buff cylindrical surfaces in a circumferential direction.

CAUTION: WHEN YOU BLEND ROTATING COMPONENTS, DO THE PROCEDURE IN THE SAME ORDER SPECIFIED IN THE PROCEDURE TO PREVENT DAMAGE TO THE PART.

(3) Special Instructions For The Blending Of Rotating Parts

NOTE: Be sure to follow all requirements in the Blending and Buffing procedures above.

(a) In areas where shotpeening is required, on-wing blending is not allowed. Blend only as specified in the specific AMM maintenance task.

(b) Blend to a sufficient depth to remove damage plus an additional 0.002 - 0.003 inch (0.051 - 0.076 mm) of material within the repair limits specified.

(c) Blending must start with the coarser grades of resilient flexible abrasive impregnated wheels, brushes, or points for the initial removal of damage, but not coarser than is necessary to remove the damage.

(d) Finish blending the part with the finer grades of abrasives until the surface is as smooth as, or smoother than, the adjacent surfaces.

(e) Use grades of abrasives in the order that follows:

1 80 mesh silicon carbide or aluminum oxide grit

2 120 mesh silicon carbide or aluminum oxide grit

3 180 mesh silicon carbide or aluminum oxide grit

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4 Optional: Use (P05-354) Polishing Compound (PMC 3017) or (P05-426) Polishing Compound (PMC 3022) or (P05-427) Polishing Compound (PMC 3023) with (P05-353) Cloth Wheel (Non-Coated) to get a surface finish, if necessary.

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Task 70-00-00-380-002:

R 1. Denicking (Blending) and Buffing/Polishing of Steel, Nickel,
R Cobalt, Aluminum, and Magnesium Alloy Parts (SPOP 533)

A. Effectivity

(1) All (727/8D, 737/8D, Super 27/8D, DC-9/8D)

B. General

(1) This task gives the general instructions for blending and buffing of steel, nickel, cobalt, aluminum, and magnesium alloy parts.

C. References

(1) Task 70-00-00-230-001, Fluorescent Penetrant Inspection (SPOP 70)

(2) Task 70-00-00-380-010, Anodized Touch-Up (SPOP 42)

D. Equipment

(1) (No specific) Pneumatic Hand Tool

(2) (No specific) Tampico Brush

(3) (No Specific) Files

(4) (No Specific) Abrasive Stone

(5) (No Specific) Abrasive Paper

(6) (No Specific) Crocus Cloth

(7) (No Specific) Abrasive Pads

(8) (No Specific) Emery Cloth

(9) (No Specific) Silicon Carbide or Aluminum Oxide Grit (80, 120, or 180 mesh)

E. Consumable Materials

NOTE: The P- numbers in this list are used in other Pratt & Whitney engine programs and are included to keep this list common with those in other engine and airframe programs.

(1) (P05-066) Buffing Polishing Compound (PMC 3061)

(2) (P05-353) Cloth Wheel (Non-Coated)

(3) (P05-354) Polishing Compound (PMC 3017)

(4) (P05-384) Silicone Carbide Deburring Compound (PMC 3088)

R (5) (P05-421) Scrub Pad (PMC 4095)

R (6) (P05-422) Scrub Pad (PMC 4435)

R (7) (P05-426) Polishing Compound (PMC 3022)

R (8) (P05-427) Polishing Compound (PMC 3023)

F. Procedure

WARNING: MAGNESIUM DUST IS EXTREMELY FLAMMABLE. FOLLOW THE PRECAUTIONS VERY CAREFULLY TO PREVENT FIRE. BE SURE TO FREQUENTLY REMOVE BLEND DUST FROM THE PART, BLEND REPAIR AREA, AND GLOVES USED DURING THE REPAIR.

CAUTION: LIMITS SPECIFIED IN THIS SECTION ARE FOR GENERAL USE ONLY. LIMITS SPECIFIED IN THE PART-SPECIFIC MANUALS TAKE PRECEDENCE. POST-BLEND SURFACE TREATMENT REQUIREMENTS WILL BE DETAILED WITHIN THE SPECIFIC BLEND REPAIR.

CAUTION: WHEN YOU DO THIS PROCEDURE, BE SURE TO USE GOOD SHOP PRACTICES AND COMMON SENSE. ABUSIVE BLENDING CAN CAUSE DAMAGE THAT IS HARMFUL TO THE LIFE AND FUNCTION OF THE REPAIRED PART.

CAUTION: TO CONTROL DUST AND NOISE CAUSED BY BLENDING, AND TO REDUCE THE RISK OF FIRE HAZARD FROM BLENDING DUST OF CERTAIN MATERIALS, WHENEVER POSSIBLE, DO THE BLENDING OPERATION IN A VENTILATED BOOTH. CONTACT YOUR LOCAL ENVIRONMENT HEALTH AND SAFETY PERSONNEL FOR SPECIFIC REQUIREMENTS.

CAUTION: USE ONLY MINIMUM PRESSURE WHEN YOU APPLY BLENDING TOOLS TO PARTS. EXCESSIVE PRESSURE AND SPEED WILL CAUSE SPARKS OR AN ORANGE-PEEL EFFECT THAT CAN POSSIBLY BE HARMFUL TO THE

PART. KEEP MATERIAL REMOVAL TO A MINIMUM. DO NOT EXCEED BLEND LIMITS.

CAUTION: DO HEAT BUILDUP CHECKS FREQUENTLY. IF THE HEAT BUILDUP IS TOO HOT TO TOUCH WITH YOUR HAND, LET THE PART BECOME COOLER BEFORE YOU CONTINUE WITH THE REPAIR. OVERHEATING OF PARTS DURING BLEND REPAIRS CAN CAUSE EMBRITTLEMENT.

CAUTION: DO NOT OVERHEAT THE PART, OR DAMAGE CAN OCCUR.

CAUTION: BE SURE TO DRESS THE ABRASIVE TOOL BEFORE BLEND REPAIRS, TO GET THE BEST OPERATION FROM THE TOOL AND TO KEEP THE CONTAMINATION FROM ONE REPAIR AWAY FROM THE SUBSEQUENT PART SURFACE..

CAUTION: USE A SHIELD OR MASK TO PROTECT SURFACE FROM DAMAGE BY ACCIDENTAL TOOL CONTACT DURING THE REPAIR.

R (1) General Blending Guidelines

(a) Blending is an operation that is used to remove nicks, scratches, high metal, and other surface irregularities by intentional removal of base metal. Manual or mechanical methods are used to produce shallow and smooth surface depressions that reduce the stress concentration from the damaged area by the distribution of the stress concentration over larger, more tolerant areas.

(b) Before you start any blend repair, examine part for cracks. Refer to Fluorescent Penetrant Inspection (SPOP 70) (AMM TASK 70-00-00-230-001).

(c) Non-toleranced enclosed areas defined in blend repairs are to corners, points of tangency between surfaces, or at points opposite one of these locations. Enclosed areas will assume a tolerance of plus 0.125 inch (3.175 mm) in all directions unless adjacent areas are specified as areas where blending is not permitted.

(d) It is better to blend sharp impact damage that is within acceptable limits than it is to accept that damage. The sharper the impact, the better it is to blend the damaged area.

(e) It is recommended that you make one single blend when the adjacent damage is so close together that the minimum length-to-depth blend ratio cannot be done independently.

(f) The depth of the blend must be as deep as necessary to remove the damage within the repair limits specified.

(g) The best blends are the ones which are smooth, continuous, and round-bottomed that extend outboard from the damage area as much as necessary. Refer to the step that follows.

(h) For rotating parts, the length of the blend must be a minimum of 15 times the maximum depth of the blend in all directions. For non-rotating parts, the length of the blend must be a minimum of 10 times the maximum depth of the blend in all directions.

R (i) For local damage in the form of raised material, manual blending (that is, blending by hand) is the preferred method.

R (j) When blending on a cylindrical surface, blend in the circumferential direction.

R (k) Blend engine radial members in a radial direction.

R (l) For parts that are smaller than 1.75 inches (44.450 mm) in length, the manual blending procedure that follows is recommended.

R (m) Manual Blending (Blending By Hand)

1. Manual blending is done with abrasive stones, abrasive pads, files, emery cloth, and/or crocus cloth.

NOTE: Blending can be done with more than one grade of abrasive (coarse to fine, as necessary) to remove damage and get the specified surface finish. Be sure to start with the least aggressive abrasive needed to remove the damage.

R (n) Mechanical Blending (Power Blending)

CAUTION: DO NOT OVERHEAT PART OR DAMAGE CAN OCCUR.

1 When blending, use a power tool (electric or air) with abrasive-impregnated wheels, stones, and/or pads.

NOTE: Blending can be done with more than one grade of abrasive (coarse to fine, as necessary) to remove damage and get the specified surface finish. Be sure to start with the least aggressive abrasive needed to remove the damage.

R 2 Use minimum pressure when you apply the
R blending tool to the part to prevent heat
R build-up. Do not let abrasive wheels to
R become loaded up with particles remaining from
R blending.

R (2) Visual Inspection of Blends

R (a) The surface finish of the blended area must be as
R smooth as, or smoother than, the initial surface.
R You can compare the surface finish with the
R adjacent non-blended surface.

R (b) All transitions from blended to non-blended areas
R must be smooth and continuous.

R (c) If the blended area intersects adjacent radii,
R the initial radius contour must be restored.
R Butterfly polish holes, as necessary.

R (d) If the blended area intersects a corner, break the
R sharp edges 0.003 - 0.015 inch (0.08 - 0.38 mm).

R (3) Buffing (Optional)

(a) Buffing is an optional operation that can be used to get the necessary surface finish while blending.

1 Buff reworked area(s) with a power tool, a tampico brush, and (P05-066) Buffing Polishing Compound (PMC 3061) or (P05-384) Silicone Carbide Deburring Compound (PMC 3088).

2 Use minimum pressure when you apply the buffing brush to the part to prevent heat build-up.

3 Buff engine radial members in a radial direction.

4 Buff cylindrical surfaces in a circumferential direction.

R (b) Polishing is an optional procedure to make minor
R scratches and burrs smooth with fine-grain
R abrasive paper, abrasive cloth, crocus cloth.
R emery cloth, or (P05-421 or P05-422) scrub pad.

R (4) Local Touch-up After Blending

(a) Aluminum Anodized Parts - To prevent corrosion damage on aluminum anodized parts after blending, do a local touch-up of the repair. Refer to Anodize Touch-Up (SPOP 42) (AMM TASK 70-00-00-380-010).

(b) Nickel-Cadmium Plated or PWA 110 Coated Parts - Refer to the engine shop P&W Standard Practices Manual - SPOP 144 for disposition and repair.

NOTE: SPOP 144 is not a typical on-wing type repair. You must measure, mix, and apply chemicals and solutions that are not normally provisioned at line stations. Refer to the P&W Standard Practices Manual (PN 585005), 70-41-03.

(c) Magnesium Parts With PWA 547 Coating - Refer to the engine shop P&W Standard Practices Manual - SPOP 155 for disposition and repair.

NOTE: SPOP 155 is not a typical on-wing type repair. You must measure, mix, and apply chemicals and solutions that are not normally provisioned at line stations. Refer to the P&W Standard Practices Manual (PN 585005), 70-41-03.

CAUTION: WHEN YOU BLEND ROTATING COMPONENTS, DO THE PROCEDURE IN THE ORDER GIVEN IN THE PROCEDURE TO PREVENT DAMAGE TO THE PART.

R (5) Special Instructions for the Blending of Rotating Parts.

R NOTE: Be sure to follow all the instructions in the
R Blending and Buffing/Polishing procedures above.

R (a) In areas where peening will be necessary, on-wing
R blend repairs are not permitted. Do blend repairs
R only as specified in the maintenance task.

R (b) Blend to a sufficient depth to remove all damage
R that is seen plus an added 0.002 - 0.003 inch
R (0.051 - 0.076 mm) of material to the repair
R limits specified.

(c) Blending must start with the coarser grades of resilient flexible abrasive-impregnated wheels, brushes, or points for the initial removal of damage, but not coarser than is needed to remove the damage.

(d) Finish blending the part with the finer grades of abrasives until the surface is as smooth as, or smoother than, the adjacent surfaces.

(e) Use grades of abrasives in the order that follows:

1 80 mesh silicon carbide or aluminum oxide grit

2 120 mesh silicon carbide or aluminum oxide grit

3 180 mesh silicon carbide or aluminum oxide grit

4 Optional: Use (P05-354) Polishing Compound (PMC 3017) or (P05-426) Polishing Compound (PMC 3022) or (P05-427) Polishing Compound (PMC 3023) with (P05-353) Cloth Wheel (Non-Coated) to get a surface finish, if necessary.

Task 70-00-00-380-010:

1. Anodize Touch-Up (SPOP 42)

A. Effectivity

(1) All (727/8D, 737/8D, Super 27/8D, DC-9/8D)

B. References

(1) Task 70-00-00-100-004, Degrease Engine Parts By Solvent Wipe (SPOP 208)

C. Equipment

(1) (No Specific) Brush

(2) (No Specific) Cloth

(3) (No Specific) Swab, Cotton

(4) (No Specific) Container, Cleaning Mixing

D. Consumable Materials

NOTE: The P- numbers in this list are used in other Pratt & Whitney engine programs and are included to keep this list common with those in other engine and airframe programs.

(1) (P05-028) Aluminum Chromate Conversion Salts (PMC 1794) (Use For Repair of AMS 2474)

(2) (P05-029) Aluminum Chromate Conversion Salts (PMC 1631) (Use For Repair of AMS 2473)

(3) (P05-030) Wetting Agent (PMC 1632)

(4) (P05-060) Demineralized Water (PMC 1737)

(5) (P05-061) Crocus Cloth

(6) (P05-062) Emery Cloth

E. Procedure

WARNING: REFER TO THE MANUFACTURER'S MATERIAL SAFETY DATA SHEETS FOR CONSUMABLE MATERIAL'S INFORMATION SUCH AS: HAZARDOUS INGREDIENTS, PHYSICAL/CHEMICAL CHARACTERISTICS, FIRE, EXPLOSION, REACTIVITY, HEALTH HAZARD DATA, PRECAUTIONS FOR SAFE HANDLING, USE AND CONTROL MEASURES.

(1) Always obey the procedures and limits in the applicable AMM maintenance tasks. Do this task only when specified by the specific AMM maintenance task.

(2) For the repair of AMS 2473 parts, prepare approximately 1 pint or 16 oz (454.0 g) of the Anodize Touch-Up Solution A as follows.

(a) Put 8 oz (227.0 g) of (P05-060) Demineralized Water (PMC 1737) in a clean Mixing Container.

NOTE: The demineralized water must have a chloride content of 10 PPM maximum.

(b) Add 0.5 oz. (14175.0 mg.) of (P05-029) Aluminum Chromate Conversion Salt (PMC 1631) to the Container.

(c) Add 0.0085 oz. (241. mg.) of the (P05-030) Wetting Agent (PMC 1632) to the container.

(d) Mix the solution together.

(e) Add 8 oz. (227. g) more of (P05-060) Demineralized Water (PMC 1737).

NOTE: The demineralized water must have a chloride content of 10 PPM maximum.

(f) Mix the solution.

NOTE: The working life the anodize touch-up solution is 14 days. The solution must be identified as to the time and date of mixing. Discard the solution after 14 days.

(3) For the repair of AMS 2474 parts, prepare approximately 1 pint or 16 oz. (454.0 g) of the Anodize Touch-Up Solution B as follows.

(a) Put 8 oz. (227.0 g) of potable water in a clean container.

(b) Add 0.25 oz. (7087.0 mg.) of (P05-028) Aluminum Chromate Conversion Salt to the container.

(c) Mix the solution together.

(d) Add 8 oz. (227.0 g) more of potable water.

(e) Mix the solution.

NOTE: The working life of the anodize touch-up solution is 14 days. The solution must be identified as to the time and date of mixing. Discard the solution after 14 days.

(4) Apply (P05-028) Anodize Touch-Up Solution A or B to the repair area as follows.

(a) Clean the repair area. Refer to Degrease Engine Parts by Solvent Wipe (SPOP 208) (Ref. 70-00-00-100-004).

1 If dirt and grease remains on the surface, use (P05-061) Crocus Cloth or (P05-062) Emery Cloth to clean the repair area.

(b) Apply the Anodize Touch-Up Solution to the repair area with a clean Brush or Cotton Swab.

NOTE: The Anodize Touch-Up Solution must wet the surface for approximately four minutes. If the solution does not wet the surface, remove the anodize touch-up solution with a clean cloth and reapply.

(c) Let the Anodize Touch-Up Solution air dry.

(5) Examine the repair area for full coverage of the Anodize Touch-Up Solution.

(a) For Anodize Touch-Up Solution A, the color must be brown.

(b) For Anodize Touch-Up Solution B, the color must be iridescent gold-to-tan.

(6) Smooth the repair area with a clean cloth.

Task 70-00-00-380-011:

R 1. Application of Epoxy Primer and Aluminized Epoxy Enamel (SPOP
R 148)

A. Effectivity

(1) All (727/8D, 737/8D, Super 27/8D, DC-9/8D)

B. General

(1) This task gives the general instructions and the approved materials for touch up application of epoxy primer and aluminized epoxy enamel.

C. References

(1) Task 70-00-00-100-004, Degrease Engine Parts by Solvent Wipe (SPOP 208)

D. Equipment

(1) (No specific) Mixing Container (Graduated)

(2) (No specific) Mixing Sticks

(3) (No specific) Paint Gun

(4) (No specific) Heat Gun

E. Consumable Materials

NOTE: The P- numbers shown in this list are used by other Pratt & Whitney engine programs and are included to keep this list common with those in other engine and airframe programs.

(1) (P05-037) Aluminized Epoxy Enamel (PWA 569)

(2) (P05-063) Solvent Reducer (PWA 36060)

(3) (P05-076) 400 Grit Abrasive Paper

(4) (P05-255) Masking Tape

R (5) (P05-482) Solvent Reducer (PWA 36106)

R (6) (P05-483) Aluminized Epoxy Enamel

R (7) (P11-065) Acetone (PMC 1914)

R (8) (P18-020) Epoxy Primer (PWA 36519-1 or PWA 36519-2)

R (9) (P18-024) Epoxy Primer (PWA 36568)

F. Procedure

(1) Always obey the specific procedures and limits in the specific AMM maintenance tasks.

(2) Clean the repair area. Refer to Degrease Engine Parts by Solvent Wipe - SPOP 208 (Ref. TASK 70-00-00-100-004).

(3) Use (P05-076) 400 Grit Abrasive Paper to lightly sand the surface.

(4) Clean the repair area again. Refer to Degrease Engine Parts by Solvent Wipe - SPOP 208 (Ref. TASK 70-00-00-100-004).

(5) Apply (P05-255) Masking Tape to the areas not to be painted.

R (6) Prepare the applicable (P18-020) Epoxy Primer (PWA
R 36519-1 or PWA 36519-2) or (P18-024) Epoxy Primer (PWA
R 36568) as follows:

R NOTE: The working life of the (P18-020) Epoxy Primer
R (PWA 36519-1 or PWA 36519-2) or (P18-024) Epoxy
R Primer (PWA 36568) mixture is approximately four
R hours at 60° - 80°F (16° - 27°C). Be sure to
R identify the time and date of the mixture.

R CAUTION: DO NOT INTERMIX THE BASE-CURING
R SOLUTION-SOLVENT SYSTEMS.

R (a) Mix the applicable (P18-020) Epoxy Primer (PWA
R 36519-1 or PWA 36519-2) or (P18-024) Epoxy Primer
R (PWA 36568) as follows:

R 1. For (P18-020) Epoxy Primer (PWA 36519-1 or PWA
R 36519-2)

NOTE: The (P18-020) Epoxy Primer comes in green (PWA 36519-1) or black (PWA 36519-2). You can use either suffix when no suffix is specified, but PWA 36519-2 is preferred because it does not contain MEK and is less hazardous than PWA 36519-1.

R a. Stir the primer base until there is no solid
R material remaining on the bottom of the container.

R b. Mix three parts by volume of the primer base with one part by volume of the curing solution.

R c. If necessary, dilute the green (P18-020) Epoxy Primer Mixture (PWA 36519-1) with (P11-065) Acetone (PMC 1914) in a ratio of
R four parts by volume of primer to one part
R by volume of acetone. It is not necessary
R to dilute the black Epoxy Primer (PWA
R 36519-2). Stir fully.

R NOTE: For (P18-020) Epoxy Primer (PWA
R 36519-1 or PWA 36519-2), it is
R permitted to decrease the volume of
R solvent for applications by brush.

R 2. For (P18-024) Epoxy Primer (PWA 36568)

R NOTE: The (P18-024) Epoxy Primer (PWA 36568)
R is a dark gray primer. This primer does
R not contain MEK and is less hazardous
R than the green PWA 36519-1.

R a. Stir the primer base until there is no solid
R material remaining on the bottom of the container.

R b. Mix seven parts by volume of the primer base
R with one part by volume of the curing
R solution. No dilution is necessary.

R (7) Apply a thin coat of the (P18-020) Epoxy Primer (PWA R 36519-1 or PWA 36519-2) or (P18-024) Epoxy Primer (PWA R 36568) to the repair area with a standard Paint Gun and filtered air supply. Air dry between coats for 5 - 10 minutes.

R NOTE: To get sufficient coverage of the repair area, R multiple coats of the (P18-020) Epoxy Primer R (PWA 36519-1 or PWA 36519-2) or (P18-024) Epoxy R Primer (PWA 36568) can be necessary.

R (8) Let the (P18-020) Epoxy Primer (PWA 36519-1 or PWA R 36519-2) or (P18-024) Epoxy Primer (PWA 36568) cure for a minimum of one hour.

R (9) Prepare the applicable (P05-037) Aluminized Epoxy R Enamel (PWA 569) or (P05-483) Aluminized Epoxy Enamel R (PWA 36569) as follows:

R (a) For (P05-037) Aluminized Epoxy Enamel (PWA 569)

R NOTE: The working life of the (P05-037) R Aluminized Epoxy Enamel (PWA 569) mixture R is approximately eight hours at 60° - 80°F R (16° - 27°C). Be sure to record the time and date of mixing.

R 1 Stir the enamel base until there is no solid R material remaining on the bottom of the container.

R 2 Mix one part by volume of the enamel base with one part by volume of the curing solution.

R 3 If necessary, add (P05-063) Solvent Reducer R (PWA 36050) to the (P05-037) Aluminized Epoxy R Enamel (PWA 569) mixture.

R 4 Let the (P05-037) Aluminized Epoxy Enamel (PWA R 569) mixture become stable for one hour before you use the mixture.

R (b) For (P05-483) Aluminized Epoxy Enamel (PWA 36569)

R NOTE: The working life of the (P05-483) R Aluminized Epoxy Enamel (PWA 36569) mixture R is approximately four hours at 60° - 80°F R (16° - 27°C). Be sure to record the time and R date of mixing.

R 1. Stir the enamel base until there is no solid material remaining on the bottom of the container.

R 2. Mix three parts by volume of the enamel base
R with one part by volume of the curing solution.

R 3. If necessary, add (P05-482) Solvent Reducer
R (PWA 36106) to the (P05-483) Aluminized Epoxy
R Enamel (PWA 36569) mixture.

R 4. Let the (P05-483) Aluminized Epoxy Enamel (PWA
R 36569) mixture become stable for 15 minutes
R before you use the mixture.

(10) Apply one coat of the (P05-037) Aluminized Epoxy Enamel
R (PWA 569) or (P05-483) Aluminized Epoxy Enamel (PWA
R 36569) mixture to the repair area with a Paint Gun and filtered air supply.

R (11) Cure the (P05-037) Aluminized Epoxy Enamel (PWA 569) or
R (P05-483) Aluminized Epoxy Enamel (PWA 36569) with a Heat Gun as follows:

R (a) For (P05-037) Aluminized Epoxy Enamel (PWA 569)

R 1. Cure (P05-037) Aluminized Epoxy Enamel (PWA
R 569) with a Heat Gun at 140° - 180°F (60° - 82°C)
R for one hour.

R (b) For (P05-483) Aluminized Epoxy Enamel (PWA 36569)

R 1. Air dry the (P05-483) Aluminized Epoxy Enamel
R (PWA 36569) for a minimum of 24 hours at room
R temperature to cure the coating sufficiently
R for handling purposes only.

R 2. Air dry the (P05-483) Aluminized Epoxy Enamel
R (PWA 36569) for seven days for full chemical
R resistance.

(12) Carefully remove the masking tape.

(13) Examine the repair area for full coverage of the aluminized epoxy enamel.

Task 70-00-00-350-020:

1. Replacement of Damaged Tube Nuts and Thrust Wire

A. Effectivity

(1) All (727/8D, 737/8D, Super 27/8D, DC-9/8D)

B. General

(1) This procedure gives the necessary instructions to replace a damaged tube nut or thrust wire on an external tube when the tube nut is retained by a thrust wire. This procedure can also be used to repair a tube which is attached inside the engine cases and cannot be removed. Repair of a tube attached inside the engine should only be done by an experienced operator following the additional steps given below.

C. References

(1) Task 70-00-00-400-043, Installation of Safety Wire

(2) Task 70-00-00-400-044, Installation of Safety Cable

D. Equipment

(1) (No specific) Caps

(2) (No Specific) Plugs

(3) (No Specific) Bantam Bully Air Hammer Available from: Superior Pneumatic And Manufacturing Inc. 855 Canterbury Rd. Westlake, OH 44145, USA

(4) PWA 21411 Anvil

E. Consumable Materials

NOTE: The P- numbers shown in this list are used by other Pratt & Whitney engine programs and are included to keep this list common with those in other engine and airframe programs.

(1) (P03-001) Engine Oil (PWA 521)

(2) (No specific) Oil or Lubricant (as specified by the specific AMM maintenance task)

F. Procedure - General Instructions for Tubes Attached Inside the Engine Cases

(1) Always obey the specific procedures and limits in the specific AMM maintenance tasks.

CAUTION: THE SUBSEQUENT STEPS SHOULD ONLY BE DONE BY AN EXPERIENCED OPERATOR. IF YOU DAMAGE A TUBE WHICH IS ATTACHED INSIDE THE ENGINE CASES, IT WILL BE NECESSARY TO REMOVE THE ENGINE FOR TUBE REPLACEMENT.

CAUTION: INSTALL PROTECTION COVERS OVER ALL OPENINGS AS SOON AS POSSIBLE TO PREVENT ENGINE DAMAGE.

(2) Disconnect the mating tube from the damaged tube nut.

(3) Cover all openings to protect them from entry by foreign objects.

(4) Put a temporary plug in the tube ferrule or fitting to keep machining chips and dirt out of the tube.

(5) If you damage a tube which is captured in the engine cases, it will be necessary to remove the engine for tube replacement.

(6) Follow the instructions in the subsequent paragraph for the removal of the thrust wire.

CAUTION: WHEN YOU INSTALL THE NEW THRUST WIRE INTO THE NEW TUBE NUT, YOU MUST SUPPORT THE TUBE NUT WITH AN OPPOSITE FORCE SO AS NOT TO DEFORM THE TUBE.

(7) When you install the new thrust wire into the new tube nut, you must support the tube nut with an opposite force.

G. Removal of the Damaged Tube Nut and Thrust Wire

CAUTION: THE INSTRUCTIONS IN THIS PARAGRAPH APPLY TO DAMAGED TUBES WHICH HAVE BEEN REMOVED FROM THE ENGINE. IF THE TUBE BEING REPAIRED IS ATTACHED INSIDE THE ENGINE CASES, YOU MUST OBEY THE PRECAUTIONS IN THE PREVIOUS PARAGRAPH.

(1) If possible, remove the damaged tube from the engine.

(2) Put a temporary plug in the tube ferrule or fitting to keep machining chips and dirt out of the tube.

(3) To remove the thrust wire from the nut, hold the drilled end and pull the wire out of the nut.

NOTE: For tubes with plain thrust wire, you can pull either end of the thrust wire out of the nut.

(4) Discard the thrust wire.

(5) If the thrust wire is damaged or too tight, it will be necessary to cut the nut off of the tube end as follows.

(a) Support the tube nut on a hard work surface or in a soft-jawed vise.

CAUTION: BE CAREFUL WITH THE CUT-OFF WHEEL NOT TO DAMAGE THE FERRULE OR FITTING ON THE TUBE.

(b) Use a high speed cut-off wheel to cut around the nut small distance outboard of the thrust wire, until the wire area is open.

(c) Remove the thrust wire and nut from the tube.

(d) Discard the thrust wire.

(6) Examine the tube end for any damage.

H. Installation of the New Tube Nut and the New Thrust Wire

(1) Always use a new thrust wire for each installation.

(2) Put the new nut in position on the end of the tube ferrule or fitting.

(3) Apply a small amount of (P03-001) Engine Oil (PWA 521) to the new thrust wire.

(4) While you install the new thrust wire, hold the tube nut as follows.

(a) For tubes removed from the engine, support the new tube nut on a bench or in a soft-jawed vise.

(b) For tubes captured inside the engine cases, support the tube nut with an opposite force.

CAUTION: BEFORE YOU PUSH THE THRUST WIRE INTO POSITION, MAKE SURE THAT THE THRUST WIRE IS ALIGNED WITH THE REAR RADIUS OF THE TUBE FERRULE OR FITTING. USE A STRONG LIGHT OR A SMALL TEST WIRE TO BE SURE THAT THE WIRE HOLE IN THE NUT WILL LET THE THRUST WIRE GO AGAINST (BUT NOT INTO) THE RADIUS ON THE FERRULE OR FITTING.

(5) With the new tube nut in position on the end of the tube, put the new thrust wire into position.

(6) If the thrust wire goes into the hole easily, tap the thrust wire into position with a brass (or other non-ferrous) mallet.

CAUTION: WHEN YOU USE AN AIR HAMMER, BE SURE NOT TO BEND THE THRUST WIRE OR PUSH THE THRUST WIRE AGAINST THE TUBE FERRULE OR FITTING.

(7) If you cannot easily push the thrust wire into the hole, examine the alignment again.

(8) If the alignment is good, use a Bantam Bully Air Hammer and a PWA 21411 Anvil to push the thrust wire into position.

(9) Make sure that the thrust wire comes out of the other side of the nut and is fully installed.

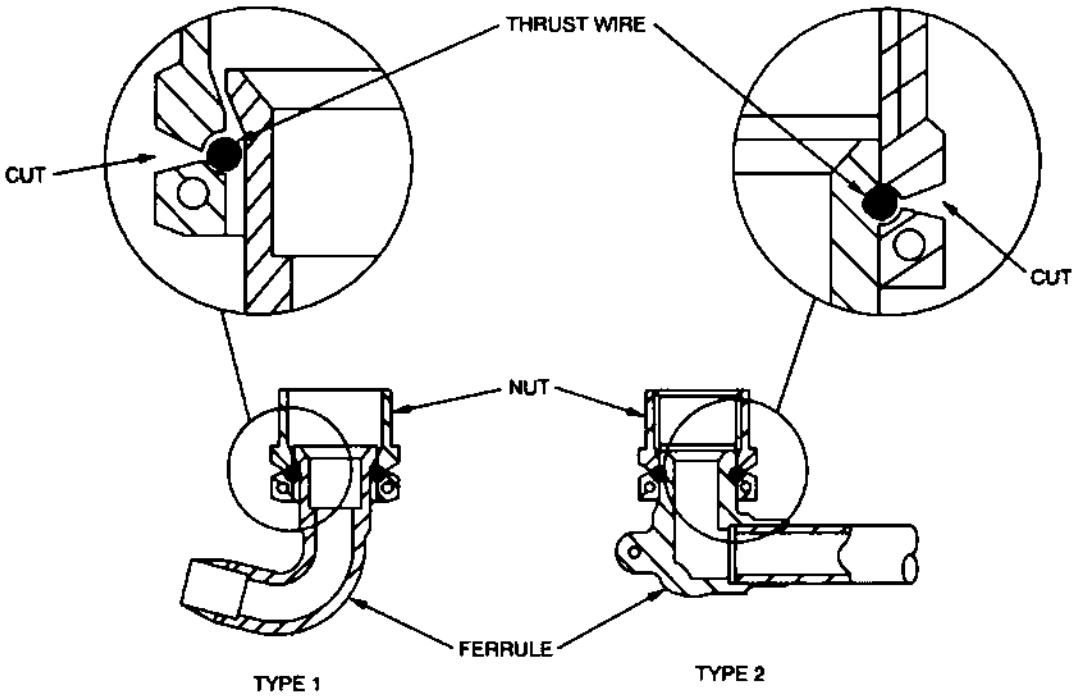
(10) Make sure the nut is held on the tube and the nut is able to turn smoothly.

(11) Remove the plug from the tube.

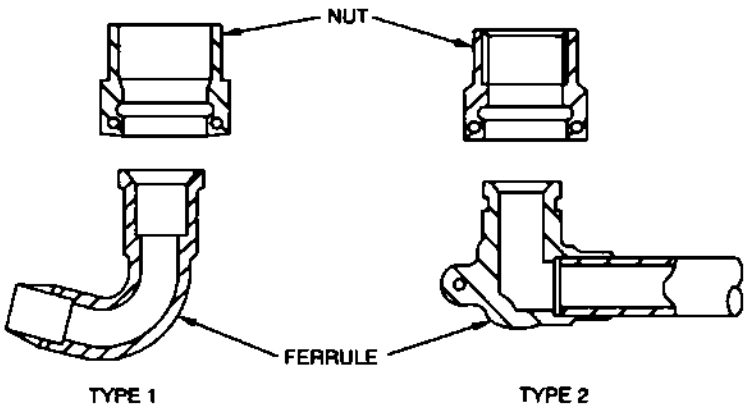
(12) Examine the tube end for any damage or blockage.

(13) If applicable, safety the thrust wire with safety wire. Refer to the Installation of Safety Wire (AMM TASK 70-00-00-440-043) or the Installation of Safety Cable (AMM TASK 70-00-00-400-044) and the specific AMM maintenance task for safety procedures.

(14) Install or connect any tubes as necessary.

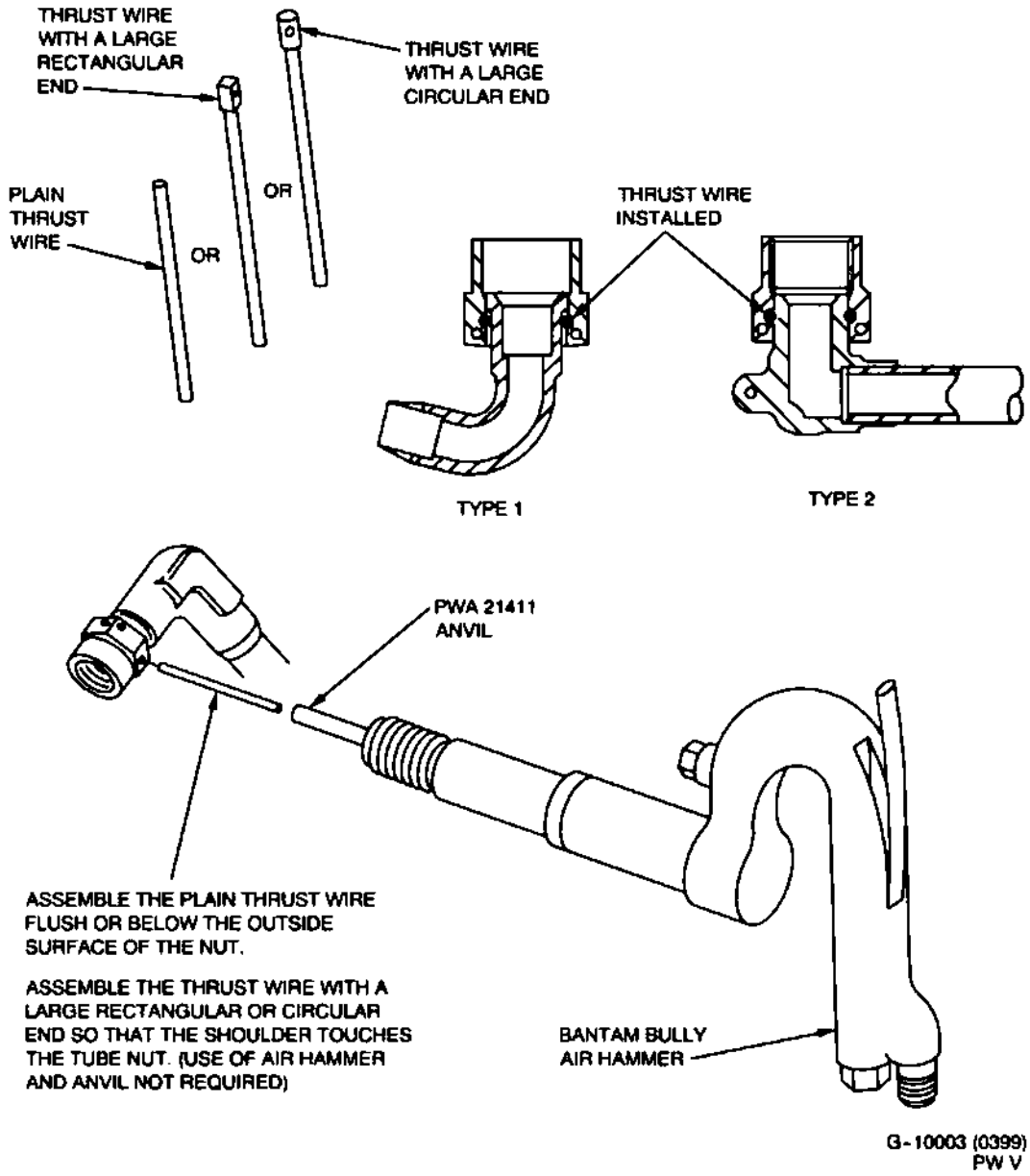


ASSEMBLED WITH THRUST WIRE INSTALLED



TYPICAL DETAILS BEFORE THRUST WIRE INSTALLATION

G-10002 (0399)
PW V


THRUST WIRE WITH A LARGE RECTANGULAR END
THRUST WIRE WITH A LARGE CIRCULAR END
OR
PLAIN THRUST WIRE
OR
THRUST WIRE INSTALLED
TYPE 1
TYPE 2
PWA 21411 ANVIL
ASSEMBLE THE PLAIN THRUST WIRE FLUSH OR BELOW THE OUTSIDE SURFACE OF THE NUT.
ASSEMBLE THE THRUST WIRE WITH A LARGE RECTANGULAR OR CIRCULAR END SO THAT THE SHOULDER TOUCHES THE TUBE NUT. (USE OF AIR HAMMER AND ANVIL NOT REQUIRED)
BANTAM BULLY AIR HAMMER
G-10003 (0399)
PW V

Replacement of Damaged
Tube Nuts and Thrust Wire
Figure 802
(Task 70-00-00-350-020)

Pratt & Whitney
JT8D MAINTENANCE MANUAL (PN 481671)

Please insert the revised pages into this manual and delete obsoleted pages in accordance with the following List of Effective Pages. Revised pages are indicated by the letter "R", added pages by the letter "A", and deleted pages by the letter "D". Superseded pages shall be removed and destroyed.

The List of Effective Pages records not only each page of subject revision but also each previously issued page which is still current. Blank pages and pages which are no longer current do not appear on this list. If there is any question about the currency of the maintained copy, it is recommended that each page of the manual be checked off against this List of Effective Pages. Any page which does not check out with this list, either by number or by date, shall be discarded. This list is reissued in its entirety whenever this manual section is revised.

Tab Separator - Standard Practices

List of Effective Pages - Standard Practices
See end of list.

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		405		OCT 15/07
		406		OCT 15/07
		407		OCT 15/07
		408		OCT 15/07
		409		OCT 15/07
		410		OCT 15/07
70-00-00				
70-00-00		401	-ALL	APR 15/03
	REM/INST-41	402		APR 15/03
		403		APR 15/03
		404		APR 15/03
70-00-00				
70-00-00		401	-ALL	APR 15/03
	REM/INST-42	402		APR 15/03
		403/404		APR 15/03
70-00-00				
70-00-00	R	401	-ALL	APR 15/10
	REM/INST-43 R	402		APR 15/10
	R	403		APR 15/10
	R	404		APR 15/10
	R	405		APR 15/10
	R	406		APR 15/10
	R	407		APR 15/10
	R	408		APR 15/10
		409		APR 15/03
		410		APR 15/03
		411		APR 15/03
		412		APR 15/03
		413		APR 15/03
		414		APR 15/03
		415		APR 15/03
		416		APR 15/03
70-00-00				
70-00-00		401	-ALL	APR 15/04
	REM/INST-44	402		APR 15/04
		403		APR 15/04
		404		APR 15/04
		405		APR 15/04
		406		APR 15/04
		407		APR 15/04
		408		APR 15/04
		409		APR 15/03
		410		APR 15/03
70-00-00				
70-00-00		401	-ALL	APR 15/05
	REM/INST-50	402		APR 15/05
		403		APR 15/05

		404		APR 15/05
		405/406		APR 15/05
70-00-00				
70-00-00		601	-ALL	APR 15/06
	INSP/CK-01	602		APR 15/06
		603		APR 15/06
		604		APR 15/06
		605/606		APR 15/06
70-00-00				
70-00-00		601	-ALL	APR 15/06
	INSP/CK-02	602		APR 15/06
		603/604		APR 15/06
70-00-00				
70-00-00		701	-ALL	OCT 15/09
	CLEANING-01	702		OCT 15/09
		703		OCT 15/09
		704		OCT 15/09
		705		OCT 15/09
		706		OCT 15/09
		707		OCT 15/09
		708		OCT 15/09
		709		OCT 15/09
		710		OCT 15/09
		711		OCT 15/09
		712		OCT 15/09
		713		OCT 15/09
		714		OCT 15/09
70-00-00				
70-00-00	R	701	-ALL	APR 15/10
	CLEANING-02 R	702		APR 15/10
	R	703		APR 15/10
	R	704		APR 15/10
	R	705		APR 15/10
	A	706		APR 15/10
70-00-00				
70-00-00		701	-ALL	APR 15/09
	CLEANING-03	702		APR 15/09
70-00-00				
70-00-00		701	-ALL	APR 15/08
	CLEANING-04	702		APR 15/08
		703		APR 15/08
		704		APR 15/08
		705		APR 15/08
		706		APR 15/08
70-00-00				
70-00-00		701	-ALL	APR 15/04
	CLEANING-05	702		APR 15/04
70-00-00				
70-00-00		701	-ALL	APR 15/04
	CLEANING-10	702		APR 15/04
70-00-00				
70-00-00		701	-ALL	APR 15/09
	CLEANING-11	702		APR 15/09
70-00-00				
70-00-00		701	-ALL	OCT 15/08
	CLEANING-20	702		OCT 15/08
70-00-00				
70-00-00		801	-ALL	OCT 15/08
	REPAIR-01	802		OCT 15/08
		803		OCT 15/08
		804		OCT 15/08
		805		OCT 15/08
		806		OCT 15/08
		807/808		OCT 15/08
70-00-00				
70-00-00		801	-ALL	OCT 15/08
	REPAIR-02	802		OCT 15/08
		803		OCT 15/08
		804		OCT 15/08
		805		OCT 15/08
		806		OCT 15/08
		807/808		OCT 15/08

70-00-00				
70-00-00		801	-ALL	APR 15/03
	REPAIR-10	802		APR 15/03
		803		APR 15/03
		804		APR 15/03
70-00-00				
70-00-00		801	-ALL	OCT 15/09
	REPAIR-11	802		OCT 15/09
		803		OCT 15/09
		804		OCT 15/09
		805/806		OCT 15/09
70-00-00				
70-00-00		801	-ALL	APR 15/03
	REPAIR-20	802		APR 15/03
		803		APR 15/03
		804		APR 15/03
		805		APR 15/03
		806		APR 15/03
70-30-00				
70-30-00		201	-ALL	APR 15/07
	STD PRAC-01	202		APR 15/07
		R 203		APR 15/10
		R 204		APR 15/10
		R 205		APR 15/10
		R 206		APR 15/10
		R 207		APR 15/10
		R 208		APR 15/10
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		R 211		APR 15/10
		R 212		APR 15/10
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		R 214		APR 15/10
		R 215		APR 15/10
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		R 246		APR 15/10
		R 247		APR 15/10
		R 248		APR 15/10
		R 249		APR 15/10
		R 250		APR 15/10
		R 251		APR 15/10
		R 252		APR 15/10
		R 253		APR 15/10

	R	254		APR 15/10
	R	255		APR 15/10
	R	256		APR 15/10
	R	257		APR 15/10
	A	258		APR 15/10
	A	259/260		APR 15/10
70-30-00				
70-30-00		201	-ALL	OCT 15/09
STD PRAC-02		202		OCT 15/09
	R	203		APR 15/10
	R	204		APR 15/10
	R	205		APR 15/10
	R	206		APR 15/10
	R	207		APR 15/10
	R	208		APR 15/10
	R	209		APR 15/10
	R	210		APR 15/10
	R	211		APR 15/10
	R	212		APR 15/10
	R	213		APR 15/10
	R	214		APR 15/10
	R	215		APR 15/10
	R	216		APR 15/10
	R	217		APR 15/10
	R	218		APR 15/10
	R	219		APR 15/10
	R	220		APR 15/10
	R	221		APR 15/10
	R	222		APR 15/10
	R	223		APR 15/10
	R	224		APR 15/10
	R	225		APR 15/10
	R	226		APR 15/10
	R	227		APR 15/10
	R	228		APR 15/10
	R	229		APR 15/10
	R	230		APR 15/10
	R	231		APR 15/10
	R	232		APR 15/10
70-71-00				
70-71-00		801	-ALL	APR 15/04
REPAIR-01		802		APR 15/04
		803		APR 15/04
		804		APR 15/04
		805/806		APR 15/03

TO: RECIPIENTS OF JT8D MAINTENANCE MANUAL, PART NUMBER 481671

REVISION NO. 139 DATED APRIL 15, 2010

HIGHLIGHTS - STANDARD PRACTICES

CHAPTER/ SECTION	PAGE NO	DESCRIPTION OF CHANGE	EFFECT OF CHANGE
70-00-00 STD PRAC-01	201 -203/ 204	Added definitions of Notes, Cautions, and Warnings. (SPM)	-ALL
70-00-00 STD PRAC-07	201 -203/ 204	Revised SPOP 416. (SPM)	-ALL
70-00-00 REM/INST-02	401 -403/ 404	Revised Antigalling/Anti-Seize Compound procedures. (SPM)	-ALL
70-00-00 REM/INST-22	401 -402	Revised contact enhancer application procedure. (R9170-Q5529)	-ALL
70-00-00 REM/INST-43	401 -402	Revised safety wire procedures (SPM)	-ALL
70-00-00 CLEANING-02	701 -705	Revised SPOP 1 text. (SPM)	-ALL
70-30-00 STD PRAC-01	203 -204 217 -218 228 -229 236 -237	Added consumable materials. (SPM)	-ALL
70-30-00 STD PRAC-02	204	Revised Source S0099. (SPM)	-ALL

CHAPTER 70

STANDARD PRACTICES

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	Standard Practices-02		201	-ALL
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	Standard Practices-03		201	-ALL
	Guidelines for the Reuse of Damaged Engines and Engine Parts		201	
	Standard Practices-04		201	-ALL
	Identification of Nuts and Bolts		201	
	Standard Practices-05		201	-ALL
	Check for Reuse of Self-Locking Fasteners		201	
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R	And Installation Of Oversize			
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SUBJECT	CHP/SEC/SUB	PAGE	EFFECTIVITY
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SUBJECT	CHP/SEC/SUB	PAGE	EFFECTIVITY
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Repair-11		801	-ALL
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Replacement of Damaged Tube Nuts and Thrust Wire		801	

SUBJECT	CHP/SEC/SUB	PAGE	EFFECTIVITY
MATERIALS AND SUPPLIERS	70-30-00		
Standard Practices-01		201	-ALL
List of Materials (Consumable Materials)		201	
Standard Practices-02		201	-ALL
Supplier Source Code List		201	
WIRING - CABLE STAINLESS STEEL WIRE BRAID REPAIR	70-71-00		
Repair-01		801	-ALL
Cable Stainless Steel Wire Braid Repair		801	

MATERIALS AND SUPPLIERS - STANDARD PRACTICES-01

Task 70-30-00-990-001:

1. List of Materials (Consumable Materials)

A. Effectivity

(1) All (727/8D, 737/8D, Super 27/8D, DC-9/8D)

B. General

WARNING: BEFORE YOU USE ANY OF THE MATERIALS SHOWN IN THIS PUBLICATION, YOU MUST KNOW ALL OF THE PRECAUTIONS RECOMMENDED BY THE MANUFACTURER OR THE SUPPLIER. THESE PRECAUTIONS TELL YOU HOW TO: - USE THE MATERIAL SAFELY - KEEP THE MATERIAL SAFELY - DISCARD THE MATERIAL SAFELY YOU MUST READ THE MATERIAL SAFETY DATA SHEETS (OSHA FORM 20 OR EQUIVALENT) TO LEARN THE RECOMMENDED PRECAUTIONS. THE SAFETY DATA SHEETS ARE SUPPLIED BY THE MANUFACTURER OR THE SUPPLIER OF THE MATERIAL.

(1) This list gives the approved consumable materials for on-wing maintenance.

(2) Always obey the specific procedures and limits in the AMM maintenance task.

(3) There are two lists which help you manage the consumable materials.

(a) Consumable Materials List

(b) Suppliers List

(4) The Consumable Materials List which follows includes all the consumable materials necessary for the power plant maintenance of all JT8D aircraft. These aircraft-engine combinations include the 727, 737, Super 27, and DC-9.

(5) In addition to this list, the Supplier Source Code List is a list of suppliers for procurement of all the consumable materials. Refer to Section 70-30-00, Materials and Suppliers - Standard Practices-02 (Task 70-30-00-990-002) in the Boeing Standard Practices Manual, PN 52A323.

(6) With the use of these three lists, operators of single or multiple aircraft-engine combinations can better manage consumable materials inventory.

TABLE	CATEGORY
01	Fuels
02	Hydraulic Fluids
03	Oils
04	Common Greases
05	Special Materials
06	Lubricants
07	Lacquers
08	Bonding and Adhesive Componds
09	Sealants
10	Anti-Ice and Deicing Materials
11	Cleaning Agents
12	Strippers
13	Pretreatment for Painting
14	Disinfectants
15	Storage Preservation
16	Structure Paints
17	Microbiological Contamination Protection Materials
18	Primer

C. Materials Index

(1) The P- number references are applicable to other Pratt & Whitney engine and airframe programs and are not applicable to JT8D. They are included here to keep this list common with those in other engine/airframe programs.

ITEM NO.	AIRLINE STOCK NO.	MATERIAL DESIGNATION	SPECIFICATION NUMBER	MATERIAL MANUFACTURERS REFERENCE AND/OR SPECIFICATION	SUPPLIER CODE
P01- FUELS					
P01-001		Fuel/Engine	PWA 522		Refer to SB 2016

ITEM NO.	AIRLINE STOCK NO.	MATERIAL DESIGNATION	SPECIFICATION NUMBER	MATERIAL MANUFACTURERS REFERENCE AND/OR SPECIFICATION	SUPPLIER CODE
P02- HYDRAULIC FLUIDS					
P02-001		Hydraulic Fluid	Spec. NSA 307.110	Hyjet IV or IVA Skydrol 500/84 Skydrol LD4	94548 76541

ITEM NO.	AIRLINE STOCK NO.	MATERIAL DESIGNATION	SPECIFICATION NUMBER	MATERIAL MANUFACTURERS REFERENCE AND/OR SPECIFICATION	SUPPLIER CODE
P03- OILS					
R P03-001		Lubricant, Aircraft Turbine Engine (Synthetic Base)	PWA 521, Type II, (Latest Revision), MIL-PRF-23699	Royco 500	07950
R				Royco 560	07950
R				Exxon-Mobil Jet Oil 254	1PWD8
R				Exxon-Mobil Jet II	1PWD8
R				Air BP Turbo Oil 2380	1UGB2
R				Air BP Castrol 5000	1UGB2
R				Air BP Turbo Oil 500	1UGB2

ITEM NO.	AIRLINE STOCK NO.	MATERIAL DESIGNATION	SPECIFICATION NUMBER	MATERIAL MANUFACTURERS REFERENCE AND/OR SPECIFICATION	SUPPLIER CODE
P03- OILS					
(CONTINUED)					
R				Air BP	1UGB2
R				Turbo Oil	
R				2197	
R				Aeroshell	54527
R				Turbine Oil	
R				500	
R				Aeroshell	54527
R				Turbine Oil	
R				560	
P03-002		Oil, Lubricating	MIL-PRF-6081 Grade 1010 (except viscosity at -40°F (-40°C) may be 3300 cs maximum):		
			PMC 9852	Royce 481	07950
				Winsor L-110-A	1M647
				Brayco 460	2R128
P03-003		Fluid, Calibrating	MIL-C-7024, Type II (Latest Revision) PMC 9041		LOCAL
P03-005		Oil, Lubricating Molybdenum Disulfide Silicone Base	MIL-L-25681		12474

ITEM NO.	AIRLINE STOCK NO.	MATERIAL DESIGNATION	SPECIFICATION NUMBER	MATERIAL MANUFACTURERS REFERENCE AND/OR SPECIFICATION	SUPPLIER CODE
P03- OILS					
P03-006		Oil, Lubricating (Low Temperature)	MIL-PRF-7870 (Latest Revision) PMC 9851	Exxon Instrument Oil	29700
P03-007		Oil, Gage Lubricant	PMC 9534	Marvel Mystery Oil	95015
P03-015		Fluid, Penetrating (Oil Type)	PMC 9545	318 Versatoil	27732
				Knock'er Loose	023V4
				LPS LST Penetrant 03020 Aerosol - Or - 03021, 03022, 03023 Bulk - Or - Technician Grade Aerosol 401712, 401724	66724
				Metal Guard 500 or Metal Guard Spray Formula	94853
P03-016		Fluid, Penetrating (Oil Type)	PMC 9503	Aerokroil	13868

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ITEM NO.	AIRLINE STOCK NO.	MATERIAL DESIGNATION	SPECIFICATION NUMBER	MATERIAL MANUFACTURERS REFERENCE AND/OR SPECIFICATION	SUPPLIER CODE
P03- OILS					
P03-017		Oil, Penetrating	SPMC 188	Solvo-Rust 81252 Super Penetrating Oil	05972
P03-019		Oil - Lubricating And Preservation. Aircraft Instrument And Bearings, Low Volatility	MIL-PRF-6085 PMC 9123		LOCAL

ITEM NO.	AIRLINE STOCK NO.	MATERIAL DESIGNATION	SPECIFICATION NUMBER	MATERIAL MANUFACTURERS REFERENCE AND/OR SPECIFICATION	SUPPLIER CODE
P04- COMMON GREASES					
P04-001		Grease Aircraft And Instrument, Gear And Actuator Screw	MIL-G-23827 (Latest Revision)		29700
P04-005		Grease (Extreme Pressure)	PMC 9630	Lubriplate No. 130A	73219
P04-006		Grease	PMC 9631	Plastilube No. 3	77163

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ITEM NO.	AIRLINE STOCK NO.	MATERIAL DESIGNATION	SPECIFICATION NUMBER	MATERIAL MANUFACTURERS REFERENCE AND/OR SPECIFICATION	SUPPLIER CODE
P04- COMMON GREASES					
P04-007		Grease	MIL-G-81322 (Latest Revision)	Thrust Reverser System Lubrication	19135

ITEM NO.	AIRLINE STOCK NO.	MATERIAL DESIGNATION	SPECIFICATION NUMBER	MATERIAL MANUFACTURERS REFERENCE AND/OR SPECIFICATION	SUPPLIER CODE
P05- SPECIAL MATERIALS					
P05-001		(Deleted)			
P05-004		Tape, Magic Mending			
P05-005		Cloth, Cotton, Lint Free			LOCAL
P05-006		Compound, Lapping Silicone Carbide (280 Grain Size)	PMC 3011	Clover Silicon Carbide Grease Mix (39401 or 39403	05972
P05-007		Leak Check, Bubble Type	PMC 9569	Leak Tec #372E	03530
			PMC 2277	Snoop Liquid Leak Detector	18034

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R

ITEM NO.	AIRLINE STOCK NO.	MATERIAL DESIGNATION	SPECIFICATION NUMBER	MATERIAL MANUFACTURERS REFERENCE AND/OR SPECIFICATION	SUPPLIER CODE
P05- SPECIAL MATERIALS					
P05-012		Tape, Adhesive (Double Sided)		Permacel 94, 96, 306, ED8112, ED8117, Or ST8117	99742
P05-014		(Deleted)			
P05-015		Primer Silicone Rubber	PWA 556	DC-1200	71984
				Visilox V-06	98500 S0076 S0117
P05-017		Wipers, Cotton (Lint Free)			LOCAL
P05-018		Pencil, Metal Marking	PMC 4059-2 (Blue)	Stock No. 02443 for Verithin No. 741 -OR- Stock No. 20044 for Col-Erase 1276 -OR- Stock No. 03332 for Prismacolor No. 901	86874
			PMC 4059-3 (Green)	Stock No. 03341 for Prismacolor No. 910 -OR- Stock No.	86874

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ITEM NO.	AIRLINE STOCK NO.	MATERIAL DESIGNATION	SPECIFICATION NUMBER	MATERIAL MANUFACTURERS REFERENCE AND/OR SPECIFICATION	SUPPLIER CODE
P05- SPECIAL MATERIALS					
(CONTINUED)					
				20046 for Col-Erase 1278	
			PMC 4059-5 (Pink)	Stock No. 03357 for Prismacolor 929	86874
			PMC 4059-6 (Red)	Stock No. 00750 for Verithin No. 750 -OR- Stock No. 20045 for Col-Erase 1277 -OR- Stock No. 20066 for Col-Erase 1297 -OR- Stock No. 03351 for Prismacolor 922	86874
			PMC 4059-7 (Silver)	Stock No. 02460 for Verithin No. 753 -OR- Stock No. 03375 for Prismacolor 949	86874

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ITEM NO.	AIRLINE STOCK NO.	MATERIAL DESIGNATION	SPECIFICATION NUMBER	MATERIAL MANUFACTURERS REFERENCE AND/OR SPECIFICATION	SUPPLIER CODE
P05- SPECIAL MATERIALS					
(CONTINUED)					
			PMC 4059-8 (White)	Stock No. 03365 for Prismacolor 938 -OR- Stock No. 02429 for Verithin No. 734 -OR- Stock No. 20055 for Col-Erase 1286	86874
			PMC 4059-9 (Yellow)	Stock No. 03346 for Prismacolor 916 -OR- Stock No. 02431 for Verithin No. 735	86874
			PMC 4059-10 (Red)	Stock No. 00750 for Verithin No. 750	86874
			PMC 4059-11 (Orange)	Stock No. 02435 for Verithin No. 737 -OR- Stock No. 03348 for	86874

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ITEM NO.	AIRLINE STOCK NO.	MATERIAL DESIGNATION	SPECIFICATION NUMBER	MATERIAL MANUFACTURERS REFERENCE AND/OR SPECIFICATION	SUPPLIER CODE
P05- SPECIAL MATERIALS					
(CONTINUED)					
				Prismacolor 918	
P05-019		(Deleted)			
P05-020		(Deleted)			
P05-021		(Deleted)			
P05-022		(Deleted)			
P05-023		Crayon	MISC 41	Phano No. 71 (Red)	70362
P05-024		(Deleted)			
P05-025		Deleted (Refer to P05-411)			
P05-026		Ink, Metal Marking	PMC 4057-1	Metal Marking Ink No. 977-9	00046
P05-027		(Deleted)			
P05-028		Chromate Conversion Salts, Aluminum	PMC 1794	Alodine #600	71410
P05-029		Chromate Conversion Salts, Aluminum	PMC 1631	Iridite No. 14-2 Compound	76071
P05-030		Wetting Agent	PMC 1632	ARP No. 2	76071
P05-031		(Deleted)			

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ITEM NO.	AIRLINE STOCK NO.	MATERIAL DESIGNATION	SPECIFICATION NUMBER	MATERIAL MANUFACTURERS REFERENCE AND/OR SPECIFICATION	SUPPLIER CODE
P05- SPECIAL MATERIALS					
P05-032		Penetrant, Fluorescent Post-Emulsified	PMC 4353-1	600	K2063
			PMC 4353-2	ZL27A	37676
			PMC 4353-3	RC65	21405
			PMC 4353-4	P230	S9502
			PMC 4353-5	P41H1	0BYN5
			PMC 4353-6	985-P13	D1940
					K6858
					02CA7
					23373
			PMC 4353-7	FP95A(M)	98733
			PMC 4353-8	F-6A/1P	S0126
P05-033		(Deleted)			
P05-034		Developer, Nonaqueous Fluorescent Penetrant	PMC 4357	Chemetall 9D1B	D1940
					23372
				Eishin Kagaku F-4S(NT)1P	S0126
				Ely LD3	K2063
				Magnaflux	37676
P05-035		(Deleted)			
P05-036		(Deleted) (See P18-020)			
P05-037		Enamel, Aluminized Epoxy	PWA 569	Enamel Base 529K002, Curing Solution 910K021	23354

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ITEM NO.	AIRLINE STOCK NO.	MATERIAL DESIGNATION	SPECIFICATION NUMBER	MATERIAL MANUFACTURERS REFERENCE AND/OR SPECIFICATION	SUPPLIER CODE
P05- SPECIAL MATERIALS					
P05-038		Cheesecloth - Bleached, New, Woven, Unsized	GA 100-2	100% Cotton, 12 x 18 Inches (Minimum) to 20 x 40 Inches (Maximum), 40 x 32 Yarns/Inch	2A851 4N020 80769
P05-039		(Deleted)			
P05-040		(Deleted)			
P05-041		Coating, Clear	PMC 1641	Crystal Clear Acrylic Spray (No. 1303)	54636
P05-042		(Deleted)			
P05-043		(Deleted)			
P05-044		(Deleted)			
P05-045		Pen and Ink, Marking	PMC 4092-1 (Red, Fine Point)	Sharpie 30000 Series - Red (Product Code 30002)	86874
			PMC 4092-2 (Red, Extra Fine Point)	Sharpie 30000 Series - Red (Product Code 35002)	86874
P05-046		(Deleted)			

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ITEM NO.	AIRLINE STOCK NO.	MATERIAL DESIGNATION	SPECIFICATION NUMBER	MATERIAL MANUFACTURERS REFERENCE AND/OR SPECIFICATION	SUPPLIER CODE
P05- SPECIAL MATERIALS					
P05-047		(Deleted)			
P05-048		Ink, White (Deleted, use P05-049)	PMC 4027	Dykem KXX-122 (No longer available, use PMC 4057-2)	98148
P05-049		Ink, Metal Marking	PMC 4057-2	Metal Marking Ink No. 977-9	00046
P05-050		Abrasive Rod, Rubberized	.3750 OD x 6" (9.525 OD x 152.400 mm)	0066XF	86297
P05-052		Tape, Tying, Glass Fiber			00768
P05-053		Coating, Polyur-ethane	PWA 36013	Laminar X-500 Black Conductive Resin Plus Pigment Component (8-B-6) and Hardener Component (50-C-3)	0KXA5

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ITEM NO.	AIRLINE STOCK NO.	MATERIAL DESIGNATION	SPECIFICATION NUMBER	MATERIAL MANUFACTURERS REFERENCE AND/OR SPECIFICATION	SUPPLIER CODE
P05- SPECIAL MATERIALS					
P05-054		Coating, Polyurethane	PWA 36014	Laminar X-500 White Surfacer Resin Plus Pigment Component (8-W-5) and Hardener Component (50-C-3)	0KXA5
P05-055		Emery Paper	#200-325 Grit		LOCAL
P05-056		Emery Paper	#60 Grit		LOCAL
P05-057		Tape, Tie		PN 190L0F-21GIG/A	83309
P05-058		Brush, Platers Tampico	GA 55-1	8313	33684
P05-059		Wax, Paraffin	PMC 9552	Mobile Wax 130	1PWD8
P05-060		Demineralized Water	PMC 1737		LOCAL
P05-061		Crocus Cloth	P-C-458 1.500 inch (38.100 mm) Width		LOCAL
P05-062		Emery Cloth	No. 400		LOCAL
P05-063		Solvent Reducer	PWA 36050	Thinning Agent 020X324	23354

ITEM NO.	AIRLINE STOCK NO.	MATERIAL DESIGNATION	SPECIFICATION NUMBER	MATERIAL MANUFACTURERS REFERENCE AND/OR SPECIFICATION	SUPPLIER CODE
P05- SPECIAL MATERIALS					
P05-064		Conditioner, Wheel Precoat	PMC 3091	Ad-Lea-Sive	75554
P05-065		Compound, Polishing, Medium Fine Greaseless	PMC 3048	Grade E	75554
P05-066		Compound, Polishing Buffing	PMC 3061	2844	75554
P05-067		Brush, Soft Bristle, Nonmetallic			LOCAL
P05-068		Nitrogen	PMC 2214		00741 07098 09785 36346
P05-069		Applicator, Wood, Cotton-tip		5-5-405	92469
P05-074		Tape, Insulating (Glass Cloth, Adhesive)		No. 27	26066
P05-076		Abrasive Paper, Silicon Carbide Waterproof	P-P-101 No. 400 Grit		LOCAL
P05-087		Tape, Pressure Sensitive, Flat Black		No. 250	26066

ITEM NO.	AIRLINE STOCK NO.	MATERIAL DESIGNATION	SPECIFICATION NUMBER	MATERIAL MANUFACTURERS REFERENCE AND/OR SPECIFICATION	SUPPLIER CODE
P05- SPECIAL MATERIALS					
P05-089		Color, Staining		Prussian Blue	98148
P05-094		Paper, Aluminum Oxide			LOCAL
P05-095		Coating, Conversion	MIL-C-5541, Class 1A (Latest Revision)		LOCAL
P05-099		Tape, Moisture Resistant, Adhesive (ASTM D 5486, Type IV, Class I), Olive Drab	PMC 4141, -1 thru -5	AC50	1VJW7
				Polyken 231	80769
				P-691	S0202
			PMC 4141, -1 thru -6	tesa 53910	38XJ0
P05-104		Cloth, Emery	240 Grit		LOCAL
P05-110		Lockwire	MS9224-03		LOCAL
P05-113		Release Agent, Fluoro-carbon			18598
P05-124		Tie, Twist			LOCAL
P05-125		Tape, Teflon		6 Mil	71643
P05-126		Brush, Short Bristle Nylon			LOCAL
P05-127		Alodine, Brush		No. 1200 (Touch-up)	84063

	ITEM NO.	AIRLINE STOCK NO.	MATERIAL DESIGNATION	SPECIFICATION NUMBER	MATERIAL MANUFACTURERS REFERENCE AND/OR SPECIFICATION	SUPPLIER CODE
	P05- SPECIAL MATERIALS					
	P05-131		Non- Metallic Grit Cloth	No. 90 Grit		LOCAL
	P05-132		Abrasive Paper	Light Grade 0		LOCAL
	P05-133		Mold Release	PWA 36007-1 (Aerosol):	MS122N/CO2 (Solvent-Based)	18598
				PWA 36007-2 (Liquid):	MS-143DF (Solvent-Based)	18598
	When PWA 36007 is specified, use PWA 36007-1. When PWA 36007-1 is specified, use PWA 36007-1, or -2 as applicable. See P05-355 for a water based alternative.					
	P05-135		Tape, Heat Reflective Aluminum Foil Backed	PMC 4235 36 Yard Rolls	(-1 Thru -11:) No. 363	52152
				Rolls	No. P-100	99742
R				1/2 Inch -2, -7:	No. 2925-7 (-6 Thru	1E1X8
R				1 Inch -3, -8:	-12:) No. 06005	1E1X8
R			Glass Cloth (Laminated)	Width As Follows:	No. 2925-7	1A319
				-1, -6: 1/2 Inch	No. 407	60890
				-2, -7: 1 Inch	-6 thru -10	
				-3, -8: 2 Inches	No. C642	07512
				-4, -9: 4 Inches		
				-5, -10: 1/4 Inch		
				- 11: 1/8		

ITEM NO.	AIRLINE STOCK NO.	MATERIAL DESIGNATION	SPECIFICATION NUMBER	MATERIAL MANUFACTURERS REFERENCE AND/OR SPECIFICATION	SUPPLIER CODE
P05- SPECIAL MATERIALS					
(CONTINUED)					
			Inch		
P05-136		Tape, High Temperature Glass Cloth	PMC 4273	All Dash Numbers Except -7:	
			Length = 36 Or	No. 361 Glass Cloth Tape	76381
			60 Yards	D/W 469	60890
			Width As Follows:	All Dash Numbers: Permacel No. 212	99742
			-1 = 1/4 Inch		
			-2 = 1/2 Inch	2915-7	07512
			-3 = 1.0 Inch		
			-4 = 2.0 Inch		
			-5 = 4.0 Inch		
			-6 = 6.0 Inch		
			-7 = 4.0 Inch	All Dash Numbers:	
			-8 = 3.0 Inch	Permacel No. 212	99742
P05-137		Bonding Prevent-ative, Teflon S	PWA 36038	No. 954-101	23037(D)
P05-142		Tape, Silicone Glass Cloth		Scotch No. 361	26066

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ITEM NO.	AIRLINE STOCK NO.	MATERIAL DESIGNATION	SPECIFICATION NUMBER	MATERIAL MANUFACTURERS REFERENCE AND/OR SPECIFICATION	SUPPLIER CODE
P05- SPECIAL MATERIALS					
P05-145		Tape, Masking Polyester Film (Mylar)	PMC 4188	Temp-R-Tape M50	07512
				No. 594 Blue Poly Flexible Tape 24-06BL115	3FJ16
				Scotch No. 8402 Or 8403	52152
				CT-931	9X057
P05-146		Abrasive Paper Silicone Carbide		120 Grit	39428
P05-147		Milled Glass		Owens-Corning	45255
P05-152		Wetting Agent	PMC 1610	Alconox	17534
P05-153		Abrasive Paper, Silicone Carbide		240 Grit	LOCAL
					03251
					39428
P05-154		Coating, Polyur-ethane	PWA 36510	Chemglaze M331 and Chemglaze M201	30676 74230
P05-155		Paper, Kraft Medium Duty	PMC 4128		80861

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ITEM NO.	AIRLINE STOCK NO.	MATERIAL DESIGNATION	SPECIFICATION NUMBER	MATERIAL MANUFACTURERS REFERENCE AND/OR SPECIFICATION	SUPPLIER CODE
P05- SPECIAL MATERIALS					
P05-169		Foil, Aluminum			LOCAL
P05-182		Cloth, Wire	PWA 1170-3		05160 S0118 S0119
P05-185		Paper, Test, PH		No. 345, Short Range 6.0 - 8.0	B0006
P05-191		Tape, Electrical Insulating, Self Adhering, High Temperature		RL-6000 SA Series	10009
P05-198		Gloves, Plastic Polyethylene	GA 660-4	Edmont And Wilson No. 35-152	44926
P05-203		Paper, Kraft Light Duty	PMC 4127	No. 40 Kraft Paper	80861
P05-214		Cloth, Abrasive Impregnated Nylon, Fine Silicon Carbide	GA 814-3	Type S Fine Scotch - Brite Cleaning And Finishing Sheets	76381
P05-221		Filler, Aerodynamic Dent		800000-328	73168

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ITEM NO.	AIRLINE STOCK NO.	MATERIAL DESIGNATION	SPECIFICATION NUMBER	MATERIAL MANUFACTURERS REFERENCE AND/OR SPECIFICATION	SUPPLIER CODE
P05- SPECIAL MATERIALS					
P05-231		Tape, Adhesive Transfer	PWA 36745	Densil 4078K Adhesive Transfer Tape	62369
P05-232		Crayon, Metal Marking (Soft)	PMC 4058-1	02089	86874
			PMC 4058-6 (Red)	02059	86874
			PMC 4058-8 (White)	02412 or 02060	86874
				Phano #92	70362
			PMC 4058-10	Orange, 02094	86874
P05-233		Brush, Tube Nylon Bristle		1/2 Inch OD And 18 Inch Long Minimum	LOCAL
P05-234		Penetrant Fluorescent Post-Emulsified Normal Sensitivity (Level 2)	PMC 4352-1	555	K2063
			PMC 4352-2	ZL2C	37676
			PMC 4352-3	RC50	21405
			PMC 4352-4	P220	S9502
			PMC 4352-5	P31H1	0BYN5
			PMC 4352-6	985-P12	D1940
					K6858
					02CA7
					23373
			PMC 4352-7	FP93A(M)	98733
			PMC 4352-8	F-5-SP/1P	S0126
P05-235		Penetrant, Fluorescent, Post-Emulsified Ultra High Sensitivity (Level 4)	PMC 4354-1	668	K2063
			PMC 4354-2	ZL37	37676
			PMC 4354-3	RC77	21405
			PMC 4354-4	P240	S9502
			PMC 4354-5	P60H2	0BYN5
			PMC 4354-6	985P14	D1940
					K6858
					02CA7

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ITEM NO.	AIRLINE STOCK NO.	MATERIAL DESIGNATION	SPECIFICATION NUMBER	MATERIAL MANUFACTURERS REFERENCE AND/OR SPECIFICATION	SUPPLIER CODE
P05- SPECIAL MATERIALS					
(CONTINUED)					
					23373
			PMC 5354-7	FP97A(M)	98733
			PMC 5354-8	F-6A-SP/1P	S0126
P05-236		Penetrant,	PMC 4360-1	446	K2063
		Fluorescent	PMC 4360-2	ZL67	37676
		Water	PMC 4360-3	HM604	21405
		Washable	PMC 4360-4	P130	S9502
		High	PMC 4360-5	WP170LS	0BYN5
		Sensitivity	PMC 4360-6	970-P25E	D1940
		(Level 3)			K6858
					02CA7
					23373
			PMC 4360-7	FP903	98733
			PMC 4360-7	F-4A-C/1P	S0126
P05-237		Developer,	PMC 4357	Chemetall	D1940
		Fluorescent		9D1B	K6858
		Penetrant			02CA7
		Nonaqueous			23373
				Eishin Kasaku F-4S(NT)1P	S0126
				Ely LD3	K2063
				Magnaflux ZP9F	37676
				Marktec D701	S9502
				Met-L-Chek D70	S9502
				Sherwin 0100	21405
				Turco NAD	0BYN5

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ITEM NO.	AIRLINE STOCK NO.	MATERIAL DESIGNATION	SPECIFICATION NUMBER	MATERIAL MANUFACTURERS REFERENCE AND/OR SPECIFICATION	SUPPLIER CODE
P05- SPECIAL MATERIALS					
P05-238		(Deleted)			
P05-240		(Deleted)			
P05-243		Paper, Emery		No. 320 Grit	LOCAL
P05-248		Tape, Red Rubber		Moxness 620-1 (Red or Black)	07099
P05-249		Coating, Urethane	MIL-C-83286, Type I, No. 26306		97460
P05-250		Coating, Urethane	MIL-C-83286 Type II, No. 26251		97460
P05-252		Pad, Scotch Brite			04963
P05-253		Paper, Abrasive	Silicon Carbide, 180 Grit		70752
P05-254		Knife, Acrylic			LOCAL
P05-255		Tape, Masking		Scotch 8402 Or 8403	76381
P05-256		Brush, Acid		No. 225	20696
P05-258		Coating, Silicone Insulation		MI-15 Type II Parts A, B And C	53100

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ITEM NO.	AIRLINE STOCK NO.	MATERIAL DESIGNATION	SPECIFICATION NUMBER	MATERIAL MANUFACTURERS REFERENCE AND/OR SPECIFICATION	SUPPLIER CODE
P05- SPECIAL MATERIALS					
P05-259		Topcoat, Silicone Insulation		MI-15 Parts A And B, Thinner	53100
P05-260		Spatula, Acrylic Or Fiber			LOCAL
P05-262		Lockwire	MS20995C32		LOCAL
P05-264		Film, Bagging (VAC-PAC)		2 MIL Nylon	66442
P05-268		Film, Release	PMC 9977-1, -3, -5	A4000 (Perforated)	53912
				A5000P (Perforated)	3BEV4
			PMC 9977-2, -4, -6	A4000 (Non-Perforated)	53912
				A5000 (Non-Perforated)	3BEV4
P05-272		Tape, Sealing		Scotch 425 Or Scotch Y427	52152
P05-273		Syringe, Plastic Nozzle			LOCAL
P05-274		Paper, Abrasive	Silicon Carbide 80 Grit		LOCAL
P05-277		Sheet, Rubber, Silicone	0.125 Inch (3.175 mm) Thick		LOCAL

ITEM NO.	AIRLINE STOCK NO.	MATERIAL DESIGNATION	SPECIFICATION NUMBER	MATERIAL MANUFACTURERS REFERENCE AND/OR SPECIFICATION	SUPPLIER CODE
P05- SPECIAL MATERIALS					
P05-278		Tape, Protective Polyurethane		3M Part No. 8672	52152
P05-279		Coating, Clear Polyurethane		683-2	98502
P05-285		Fabric Fiberglass Epoxy		Type I HMF 2398D/76 Type II HMF 2367D/76	07314
P05-287		Safety Wire (Lockwire)	MS20995C20	0.020 Inch (0.508 mm) Diameter	LOCAL
P05-288		Safety Wire (Lockwire) - Steel, Corrosion Resistant	AS3214-01 (AMS 5689, AISI 321)	0.020 Inch (0.508 mm) Diameter	LOCAL 1A053 94129
P05-289		Safety Wire (Lockwire) - Steel, Corrosion Resistant	AS3214-02 (AMS 5689, AISI 321)	0.032 Inch (0.813 mm) Diameter	LOCAL 1A053 94129

NOTE: P05-332 is an approved alternative to P05-289.

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ITEM NO.	AIRLINE STOCK NO.	MATERIAL DESIGNATION	SPECIFICATION NUMBER	MATERIAL MANUFACTURERS REFERENCE AND/OR SPECIFICATION	SUPPLIER CODE
P05- SPECIAL MATERIALS					
P05-291		Cable, Safety		C30B AS3510-0212C AS3510-0218C AS3510-0221C AS3510-0224C 0.032 Inch (0.813 mm) Diameter	70958
P05-292		Ferrule, Safety Cable		F30B50 AS3510-02F 0.032 Inch (0.813 mm) Diameter	70958
P05-303		Sponge, Silicone Rubber, 0.040 Inch Thick		AMS 3195	50744
P05-317		Adhesion Promoter, Polyurethane Protective Tape		Adhesion Promoter 86A	52152
P05-332		Safety Wire (Lockwire)		0.032 Inch (0.813 mm) Diameter	LOCAL
NOTE: P05-289 is an approved alternative to P05-332.					
P05-350		Wheel, Grinding Rubber Bonded "Radiac"		C100-102CHSC	54916 S0055
P05-351		Deleted (Not Available)			

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	ITEM NO.	AIRLINE STOCK NO.	MATERIAL DESIGNATION	SPECIFICATION NUMBER	MATERIAL MANUFACTURERS REFERENCE AND/OR SPECIFICATION	SUPPLIER CODE
	P05- SPECIAL MATERIALS					
	P05-353		Wheel, Cloth			LOCAL
	P05-354		Compound, Aluminum Oxide Polishing And Buffing	PMC 3017	Moco 1062	S0055
	P05-360		Applicator, Manual (LP-50 Cartridge)		9MGUN509X	30676
	P05-361		Nozzle, Mixing		9742	30676
	P05-370		Coating, Fluoroelas-tomer Protective	PWA 36516-1	PLV 2000 (Black Accelerator #4	24802
	P05-371		Coating, Fluoroelas-tomer Protective	PWA 36516-2	PLV 2100 (Black Accelerator #4	24802
	P05-372		Coating, Fluoroelas-tomer Protective	PWA 36516-4	PELSEAL 2112 (Black Accelerator #4	24802
R	P05-376		Tape,	PMC 4000	PG-500	1VJW7
R			Masking	-1 Thru		
R			(Crepe	-10		
R			Paper	-1 Thru -8	PG-16	1VJW7
			Backing)	And -10		
			Length:		107-00	0A9Y2
			60 Yards;			
R			Width/		200 Paper	04963
R			Suffix:		Tape	
			1/8 Inch:			
R			(-1,-11,-21)	PMC 4000	PG-21	1VJW7

	ITEM NO.	AIRLINE STOCK NO.	MATERIAL DESIGNATION	SPECIFICATION NUMBER	MATERIAL MANUFACTURERS REFERENCE AND/OR SPECIFICATION	SUPPLIER CODE
	P05- SPECIAL MATERIALS					
	(CONTINUED)					
			1/4 Inch: (-2,-12,-22) 3/8 Inch: (-3,-13,-23) 1/2 Inch:	-1 thru -8 And thru -10 thru -20		
R R R			(-4,-14,-24) 3/4 Inch: (-5,-15,-25) 7/8 Inch: (-6,-16,-26) 1 Inch: (-7,-17,-27) 2 Inch: (-8,-18,-28) 4 Inch: (-9,-19,-29) 1-1/2 Inch (-10,-20,-30)	PMC 4000 -21 thru -30	Scotch# 232 And 234	04963
	P05-384		Compound, Silicon Carbide Deburring (150 Grit And Finer)	PMC 3088	Burring Compound No. 7280	S0055
	P05-395		Beeswax	PMC 9463-1 And -2	White Beeswax S.P. 422	0A341
				PMC 9463-3 And -4	W-27 Beeswax (Yellow - Natural)	22527 94480
					Beeswax (Yellow - Natural)	33629
					Yellow Beeswax S.P. 6	0A341

ITEM NO.	AIRLINE STOCK NO.	MATERIAL DESIGNATION	SPECIFICATION NUMBER	MATERIAL MANUFACTURERS REFERENCE AND/OR SPECIFICATION	SUPPLIER CODE
P05- SPECIAL MATERIALS					
P05-396		Paraffin Wax Blend	PMC 9462	Schaefer No. 7 Wax (1 lb. (0.45 kg) Slab)	24269
P05-399		Cloth, Aluminum Oxide Oxide			04963 06565 44197
P05-408		Marker, Felt Tip	SPMC 198-1	Hi Purity Action Marker #44729 - 4.5 X 25.4 mm Tip #33729 - 2.0 X 14.5 mm Tip	98148
P05-409		Marker, Metal Tip	SPMC 198-2	Hi Purity Texpen #17470 - Fine Tip #17473 - Medium Tip #17474 - Broad Tip	98148
P05-410		Marker, Felt Tip	SPMC 198-3	Sharpie Fine Point Marker "Yellow"	86874
P05-411		Ink, Black, Stamping	PMC 4021	Dykem KX425 Permanent Stamp Pad	98148 86874

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ITEM NO.	AIRLINE STOCK NO.	MATERIAL DESIGNATION	SPECIFICATION NUMBER	MATERIAL MANUFACTURERS REFERENCE AND/OR SPECIFICATION	SUPPLIER CODE
P05- SPECIAL MATERIALS					
P05-412		Ink, White, Stamping (Deleted, use P05-049)	PMC 4027 (Deleted, use PMC 4057-2)	No Longer Available)	
P05-413		Ink, Permanent Marking	PMC 4500	16-2000 VideoJet Ink	S0113
P05-414		Marker, Extra Fine Point (Black)	PMC 4557	Pilot SC-UF or SCA-UF	58595
P05-415		(Deleted Refer to P05-423)	(PMC 4556-1,-2 Replaced by PMC 4050 -20, -21)		
P05-416		Chalk, White	PMC 4552	No. 1400 Crayola An-Du-Septic White Chalk	85419
P05-417		Marking Pen (Paint)	PMC 4554	63613 (white) and 63605 (yellow)	86874
P05-418		Dye, Layout and Identification (Blue)	PMC 4504	Dykem Steel Blue DX-100	98148
P05-420		Marking Pencil (Hard)	PMC 4094	02460 or 21628	86874

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ITEM NO.	AIRLINE STOCK NO.	MATERIAL DESIGNATION	SPECIFICATION NUMBER	MATERIAL MANUFACTURERS REFERENCE AND/OR SPECIFICATION	SUPPLIER CODE
P05- SPECIAL MATERIALS					
P05-421		Pad, Scrub	PMC 4095	Scotch Brite #7447 General Purpose Pads	28124
				747 Non-Woven Pad	44197
				54902	17699
P05-422		Pad, Scrub	PMC 4435	Scotch Brite Ultra Fine Pad #7448	76381
P05-423		Marker, Felt Tip, Rapid Drying	PMC 4050-1 (Black, Chisel Point)	Deluxe Marker #10101 or King Size Marker #15101 or TEX #13501 Broad Tip or Magnum 44 #44101	86874
			PMC 4050-2 (Blue, Chisel Point	Deluxe Marker #10103 or Magnum 44 #44103 or King Size Marker #15103	86874
			PMC 4050-3 (Red, Chisel Point)	Deluxe Marker #10102 or Magnum 44 #44102 or	86874

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ITEM NO.	AIRLINE STOCK NO.	MATERIAL DESIGNATION	SPECIFICATION NUMBER	MATERIAL MANUFACTURERS REFERENCE AND/OR SPECIFICATION	SUPPLIER CODE
P05- SPECIAL MATERIALS					
(CONTINUED)					
				King Size Marker #15102)	
			PMC 4050-4 (Black, Fine Point)	TEC #13401 Fine Tip or Sharpie 3000 Series Black (Product Code 30001)	86874
				Dixon Redi-Sharp	S0150
			PMC 4050-5 (Green, Chisel Point)	Deluxe Marker #10104	86874
			PMC 4050-6 (Blue, Chisel Point)	Sharpie 30000 Series - Blue (Product Code 30003)	86874
			PMC 4050-7 (Red, Fine Point)	Sharpie 30000 Series - Red (Product Code 30002)	86874
			PMC 4050-9	Carter's Permanent Marker or Marks-A-Lot	16956
			PMC 4050-20	TEC #13401 Fine Tip	86874
			PMC	TEC #13501	86874

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ITEM NO.	AIRLINE STOCK NO.	MATERIAL DESIGNATION	SPECIFICATION NUMBER	MATERIAL MANUFACTURERS REFERENCE AND/OR SPECIFICATION	SUPPLIER CODE
P05- SPECIAL MATERIALS					
(CONTINUED)					
			4050-21	Broad Tip	
P05-424		Penetrant, Fluorescent, Water Washable High Sensitivity (Level 2)	PMC 4351-1	Ely Chemical 4455	K2063
			PMC 4351-2	Magnaflux ZL60D	37676
			PMC 4351-3	Sherwin HM406	21405
			PMC 4351-4	Marktec P121	S9502
			PMC 4351-5	Turco WP10OH	0BYN5
			PMC 4351-6	Chemetall	D1940
				Oakite 970-P24	02CA7 23373
			PMC 4351-7	Met-L-Chek FP922	98733
P05-425		Markers, Felt Tip	PMC 4050 (Supersedes PMC 4421)		
			-4: Fine Point	Marks-A-Lot	16956
				Dixon Redisharp	70362
				TEC #13401 Fine Tip -OR-	86874
				#30001 - Black (1 mm line width)	86874
			-6: Fine Point	#30003 - Blue (1 mm line width)	86874
			-7: Fine	#30002 - Red	86874

ITEM NO.	AIRLINE STOCK NO.	MATERIAL DESIGNATION	SPECIFICATION NUMBER	MATERIAL MANUFACTURERS REFERENCE AND/OR SPECIFICATION	SUPPLIER CODE
P05- SPECIAL MATERIALS					
(CONTINUED)					
				Point (1 mm line width)	
			-10: Fine Point	#30005 - Yellow (1 mm line width)	86874
			-11: Extra Fine Point	#35001 - Black (.4 mm line width)	86874
			-12: Extra Fine Point	#35002 - Red (.4 mm line width)	86874
			-13: Extra Fine Point	#35003 - Blue (.4 mm line width)	86874
			-14: Ultra Fine Point	#37000 - Black (.3 mm line width	86874
			-15: Ultra Fine Point	#37002 - Red (.3 mm line width)	86874
			-16: Ultra Fine Point	#37003 - Blue (.3 mm line width)	86874
			-17: Bold Fine Point	#33001 - Black (4 mm line width)	86874
			-18: Bold Fine Point	#33002 - Red (4 mm line width)	86874

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	ITEM NO.	AIRLINE STOCK NO.	MATERIAL DESIGNATION	SPECIFICATION NUMBER	MATERIAL MANUFACTURERS REFERENCE AND/OR SPECIFICATION	SUPPLIER CODE
	P05- SPECIAL MATERIALS					
	(CONTINUED)					
				-19: Bold Fine Point	#33003 - Blue (4 mm line width)	86874
	P05-426		Compound, Polishing Greaseless, Coarse	PMC 3022	Greaseless Compound Grade 3022-1	75554
	P05-427		Compound, Polishing, Greaseless Fine	PMC 3023	Greaseless Compound A	75554
	P05-441		Ink, Metal Marking	PMC 4057-10	White Drawing Ink #9065-D	75364
	P05-442		Wheel, Abrasive Impregnated Nylon (80 Grit)		2 X 1/2 inch Bear-Tex	06565
	P05-443		Wheel, Abrasive Impregnated Nylon (120 Grit)		2 X 1/2 inch Bear-Tex	06565
	P05-444		Wheel, Abrasive Impregnated Nylon (180 Grit)		2 X 1/2 inch Bear-Tex	06565
R	P05-453		Tape, Masking (Cloth Backing)	PMC 4001	Shurtape PC-622	S0202

ITEM NO.	AIRLINE STOCK NO.	MATERIAL DESIGNATION	SPECIFICATION NUMBER	MATERIAL MANUFACTURERS REFERENCE AND/OR SPECIFICATION	SUPPLIER CODE
P05- SPECIAL MATERIALS					
P05-454		Tape (High Temperature)	PMC 4009	Tape 110	0A9Y2
				Scotch High Temperature #213	28112
				PG-8	3EU06
R				tesa 53134	38XJ0
P05-455		Tape Fiberglass PTFE Coated	PMC 4107	5453	52152
				M520	5R603
P05-459		Blue Dye	PMC 4513	Oil Blue B Liquid Dye	1ML15
P05-462		Tape, Fluorocarbon, Pressure Sensitive	PMC 4467, -1:	Teflease MG2	53912
				TM6115	59688
			-2:	Tooltec CSC TM6115-03	53912 59688
			-3 thru -27, -30 thru -37:	TM6115	59688
			-28:	Tooltec CA5	53912
P05-464		Mold Release Agent for Silicone (Water-Based)	PMC 1104	Perma-Mold 2580W	2W738 72430
P05-482		Solvent Reducer	PWA 36106	IP-715 Solvent Reducer	00BB6

ITEM NO.	AIRLINE STOCK NO.	MATERIAL DESIGNATION	SPECIFICATION NUMBER	MATERIAL MANUFACTURERS REFERENCE AND/OR SPECIFICATION	SUPPLIER CODE
P05- SPECIAL MATERIALS					
P05-483		Enamel - Aluminized Epoxy, Room Temperature Curing, Chromate-Free, Low Volatile Organic Compound Content	PWA 36569	Enamel Base (IP-715A Base) + Curing Solution (IP-715B Catalyst)	00BB6 00BB6

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ITEM NO.	AIR-LINE STOCK NO.	MATERIAL DESIGNATION	SPECIFI-CATION NUMBER	MATERIAL MANUFAC-TURERS REFERENCE AND/OR SPECIFI-CATION	SUP-PLIER CODE
P06- LUBRICANTS					
P06-001		Lubricant, Dry Film	PMC 9934-1	dgf 123	16837
P06-002		Petrolatum White	PMC 9609	White Fonoline or White Protopet 1S	78369
				Vaseline	92469
				Penreco Regent or Penreco Snow	00BA9
P06-003		Replaced by P06-054			
P06-004		Lubricant, Spray Type	PMC 1714	Everlube 620C	8F024
			PMC 1714	620C	
P06-005		Lubricant	PWA 587	G-N Metal Assembly Paste	71984
P06-007		Petroleum Jelly (Deleted, use P06-002)		Vaseline	
P06-009		Compound,	MIL-M-7866	Dow Corning Z Moly Powder	71984
		Antiseize	PMC 9523		

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ITEM NO.	AIR-LINE STOCK NO.	MATERIAL DESIGNATION	SPECIFICATION NUMBER	MATERIAL MANUFACTURERS REFERENCE AND/OR SPECIFICATION	SUPPLIER CODE
P06- LUBRICANTS					
P06-013		Lubricant Solid Film (Air Cure)	MIL-L-23398 (Latest Revision)	3402C Bonded Lube	71984
P06-014		Lubricant, Gasket	PMC 9652	Gredag R-3	70079
P06-015		Beeswax	Deleted, Moved To P05-395		
P06-016		Compound, Antiseize and Anti-galling (Cancelled)	PMC 9936 (See NOTE)		
P06-017		Lubricant, Antiseize	PWA 541	Molybdenum Disulfide Powder	71984
				Z Moly Powder -PLUS- Grade 1010 Oil:	71984
				Brayco 460 or	2R128
				Royco 481 or	07950
				Winsor L110-A	1M647

NOTE: P06-016 is no longer manufactured. For a replacement, refer to 70-00-00, Removal/Installation-02 (Task 70-00-00-400-002).

ITEM NO.	AIR-LINE STOCK NO.	MATERIAL DESIGNATION	SPECIFI-CATION NUMBER	MATERIAL MANUFAC-TURERS REFERENCE AND/OR SPECIFI-CATION	SUP-PLIER CODE
P06- LUBRICANTS					
P06-019		Lubricant Bolt	PMC 9866 (Not Available, use P03-001)	A11-Oil Gear Lube SAE 250 (No longer available, use remaining supplies)	
P06-020		Lubricant Bolt, Molybdenum Disulfide	MIL-L-25681 (Latest Revision)		12474
P06-021		Compound, Antigalling	PWA 550-3	Hi-T 650	34227
				Lubri-Bond HT	8F024
P06-023		Lubricant, Thread	PWA 36001 PMC 9940	Silver Goop	02570
P06-035		Fluid, Lubricating	PWA 36511	3M Company FC-43	28112
P06-036		Compound, Antigallant	PWA 36035	Loctite Moly Dry Film	05972
P06-037		Compound, Anti-seize	PWA 36053-4	JET-LUBE	0A307
				NIKAL	8F024
P06-038		Compound, Antigallant	PWA 36545-3	Everlube Esnalube 382	8F024

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ITEM NO.	AIR-LINE STOCK NO.	MATERIAL DESIGNATION	SPECIFI-CATION NUMBER	MATERIAL MANUFAC-TURERS REFERENCE AND/OR SPECIFI-CATION	SUP-PLIER CODE
P06- LUBRICANTS					
P06-039		Lubricant Anti-seize (Deleted, use P06-055)			
P06-043		Compound, Anti-Seize	PWA 36053-1	NEVER-SEEZ Pure Nickel Special	5W425 75437
P06-044		Compound, Antigallant	PWA 36240	Dow Corning 321 Dry Film Lubricant Spray	71984 77445
P06-053		Lubricant, Sealing Ring	PWA 36500	Ultrachem Assembly Fluid #1 ROYCO HF825	56385 07950
P06-054		Paste, Anti-Seize Compound, Paste, Anti-Seize	PWA 36246-1 PWA 36246-2	Tiodize T8E Molykote P-37	34568 71984
P06-059		Lubricant, Fluorinated Grease	PWA 36230	Krytox 283 AD	23037 (A) 18598

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ITEM NO.	AIRLINE STOCK NO.	MATERIAL DESIGNATION	SPECIFICATION NUMBER	MATERIAL MANUFACTURERS REFERENCE AND/OR SPECIFICATION	SUPPLIER CODE
P07-LACQUERS					
		None Designated			

ITEM NO.	AIRLINE STOCK NO.	MATERIAL DESIGNATION	SPECIFICATION NUMBER	MATERIAL MANUFACTURERS REFERENCE AND/OR SPECIFICATION	SUPPLIER CODE
P08- BONDING AND ADHESIVE COMPOUNDS					
P08-001		Epoxy, Multi-Component Type	PWA 604-1	Resin Base, Eccobond 45 Hardener, Eccoband 15	04552
P08-002		Liquid Epoxy Resin	PWA 421-2	Epon No. 828	18598 54527 74230
P08-005		Adhesive	PWA 36027	Scotch Grip Rubber Adhesive No. 1300	76381
P08-011		Thickening Agent	PWA 424-2	CAB-O-SIL-MS	3P733
P08-012		Epoxy Resin Curing Agent Curing Agent (Amine Type)	PWA 422-1	Epon Curing Ag "U" or Agent U or Epicure 3282	18598 54527 74230
P08-016		Adhesive Paste Epoxy	PWA 457-1	EA934NA	33564

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ITEM NO.	AIRLINE STOCK NO.	MATERIAL DESIGNATION	SPECIFICATION NUMBER	MATERIAL MANUFACTURERS REFERENCE AND/OR SPECIFICATION	SUPPLIER CODE
P08- BONDING AND ADHESIVE COMPOUNDS					
P08-020		Thickening Agent	PWA 424-1	Cab-O-S.1 HS-5	3F733 65483
P08-021		Compound, Potting, Epoxy	PWA 603	Eccobond SF-40	04552
P08-024		Compound, Retaining	MIL-S-46163 (Latest Revision)		05972
P08-025		Adhesive, Paste, Epoxy, Thixotrophic, Aluminum Filled	PWA 457-2	EA9394	33564
P08-026		Adhesive, Epoxy Film		FM-300, Supported	07542
P08-030		Filler, Epoxy	PWA 36756	EC3524 B/A	6A670
P08-036		Resin And Curing Agent, Liquid Epoxy	PWA 466	EPON 828/ Curing Agent U Sempak Or Epi-cure 3283 Epi-cure 3282	23354 74230 74230
P08-038		Adhesive, Urethane		7520A/B, LP-50 Cartridge	30676

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ITEM NO.	AIRLINE STOCK NO.	MATERIAL DESIGNATION	SPECIFICATION NUMBER	MATERIAL MANUFACTURERS REFERENCE AND/OR SPECIFICATION	SUPPLIER CODE
P09- SEALANTS					
P09-001		Sealant, Silicone With Catalyst		DC-90-006	71984
				DC-90-006-2	
P09-002		Compound, Thread Lcoking and Retaining	PWA-549-1	Loctite Grade 640 Green - Retaining	05972
		*Specify Grade	PWA-549-2	Loctite Grade 640 Green - Retaining	
			PWA-549-3	Loctite Grade 635 Green - Retaining	
			PWA-549-4	Loctite Grade 222 Purple - Thread Lock	
			PWA-549-5	Loctite Grade 242 Blue - Thread Lock	
			PWA-549-6	Loctite Grade 271 Red - Thread Lock	
			PWA-549-7	Loctite Grade 290 Green - Thread Lock	

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ITEM NO.	AIRLINE STOCK NO.	MATERIAL DESIGNATION	SPECIFICATION NUMBER	MATERIAL MANUFACTURERS REFERENCE AND/OR SPECIFICATION	SUPPLIER CODE
P09- SEALANTS					
(CONTINUED)					
			PWA-549-8	Loctite Grade 567 Off-white - Thread Lock	
			PWA-549-9	Loctite Grad 272 Red - Thread Lock	
			PWA-549-10 (can be a substitute for PWA 549-2)	Loctite Grade 620 Green - Retaining	
P09-003		Sealant, Silicone Rubber	PMC 9926	DC-4	71984
P09-005		Sealing Compound	PWA 36000-3	HPF 490200 (Advanced Formulation)	S0156 B1050 S0101
P09-006		Sealing Compound	PWA 36000-4	HPF 490200 (Advanced Formulation)	S0156 B1050 S0101
P09-007		Sealing Compound	PMC 9925	Aviation Form-A Gasket No. 3	05972

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ITEM NO.	AIRLINE STOCK NO.	MATERIAL DESIGNATION	SPECIFICATION NUMBER	MATERIAL MANUFACTURERS REFERENCE AND/OR SPECIFICATION	SUPPLIER CODE
P09- SEALANTS					
P09-008		Sealing Compound	PMC 9931 (Canceled)	Aviation Form-A Gasket No. 2	
			PWA 36002	Gasket Sealant No. 2	05972
P09-009		Sealing Compound	PMC 9929	Parker-Lube	02697
P09-013		Sealing Compound	MIL-S-81733 (Latest Revision)	PR-1431G Type I	98500
					99891
					01139(B)
P09-027		Sealant, Silicone Rubber	PWA 36003-2	RTV-157 (Gray)	01139
P09-035		Compound, Sealing	MIL-S-83430 Class B 1/2 PR-1750, Class B (Latest Revision)		LOCAL
P09-051		Sealant, Silicone Rubber	PWA 36028	RTV630	01139

ITEM NO.	AIR-LINE STOCK NO.	MATERIAL DESIGNATION	SPECIFICATION NUMBER	MATERIAL MANUFACTURERS REFERENCE AND/OR SPECIFICATION	SUPPLIER CODE
R P11- CLEANING AGENTS					
R					#70-30-00
P11-001		Solution		Bendix	STD PRAC-01

ITEM NO.	AIR-LINE STOCK NO.	MATERIAL DESIGNATION	SPECIFICATION NUMBER	MATERIAL MANUFACTURERS REFERENCE AND/OR SPECIFICATION	SUPPLIER CODE
P11- CLEANING AGENTS					
(CONTINUED)					
		Cleaning		25-1 Detergent (Mixed With De-Ionized Water)	
P11-002		(Deleted)			
P11-003		Kerosene	VV-K-211 PMC 9021		LOCAL
P11-004		Solvent, Cleaning	PMC 9010 140°F	Safety-Kleen Premium Solvent #6605 or Premium Gold Solvent 6638	30530
				Solvent 142 3% Aromatics Maximum	34897
P11-005		Methyl Ethyl Ketone (MEK)	PMC 9076	Technical Grade	LOCAL

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ITEM NO.	AIR-LINE STOCK NO.	MATERIAL DESIGNATION	SPECIFICATION NUMBER	MATERIAL MANUFACTURERS REFERENCE AND/OR SPECIFICATION	SUPPLIER CODE
P11- CLEANING AGENTS					
P11-005A		Solvent, Methyl Ethyl Ketone (MEK)	PMC 1820	Reagent Grade	LOCAL
P11-006		(Deleted)			
P11-009		Alcohol, Denatured Ethyl	AMS 3002		LOCAL
			PMC 9009		LOCAL
Per the Aerospace National Emission Standards for Hazardous Air Pollutants (NESHAP), procure only denatured alcohol with a vapor pressure of 45 mm Hg or less at 68°F (20.0°C).					
P11-013		Trichloro-ethylene	0-T-634 Type II PMC 9004	Perm-A-Clor NA	17125
				Blaco-Tri Trichlor-ethylene	95643 96717 0AH54
				Triclene D	2G152
P11-014		Alcohol, Isopropyl	TT-I-735 PMC 9094	Technical Grade	LOCAL
PMC 9094-9 must meet the requirements of the latest issue of AMS 3819 (Cloths, Cleaning for Aircraft Primary and Secondary Structural Surfaces).					

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ITEM NO.	AIR-LINE STOCK NO.	MATERIAL DESIGNATION	SPECIFICATION NUMBER	MATERIAL MANUFACTURERS REFERENCE AND/OR SPECIFICATION	SUPPLIER CODE
P11- CLEANING AGENTS					
P11-014A		Alcohol, Isopropyl	PMC 9016	Reagent Grade, Semi-grade, or Federal Specification TT-1-735a (Grade A)	LOCAL
P11-021		Cleaner, Gaspath	SPMC 87-1	*Ardrox 6343	D1940 K6858 02CA7 23373
		*Solvent Type **Detergent Type	SPMC 87-2	**Ardrox 6345	D1940 K6858 02CA7 23373
			SPMC 87-3	*Ardrox/ 252-L	D1940 K6858 02CA7 23373
			SPMC 87-4	*B And B 3100	21361
			SPMC 87-5	**B And B TC100	21361
			SPMC 87-6	*Cee-Bee R-674	71361
			SPMC 87-7	* Penair M5704A	56883

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ITEM NO.	AIR-LINE STOCK NO.	MATERIAL DESIGNATION	SPECIFICATION NUMBER	MATERIAL MANUFACTURERS REFERENCE AND/OR SPECIFICATION	SUPPLIER CODE
P11- CLEANING AGENTS					
(CONTINUED)					
			SPMC 87-8	(Deleted)	56883
			SPMC 87-9A	**ECT R-MC (Part No. 4070 Pre-mixed)	S0141
			SPMC 87-9B:	**ECT R-MC (Part No. 4072 Concentrate)	S0141
			SPMC 87-10A	**ARDOX 6367	D1940 K6858 02CA7 23373
			SPMC 87-10B	**ARDROX 6368	D1940 K6858 02CA7 23373
			SPMC 87-11A	**Turco 6788-3	0BYN5
			SPMC 87-11B	**Turco 6783-10	0BYN5
			SPMC 87-11C	**Turco 6783-50	0BYN5
			SPMC 87-12	*Turco T-5884	0BYN5
			SPMC 87-13	**ZOK 27	1NCU0 U4628
			SPMC 87-14	**Turbo-K	S0170

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ITEM NO.	AIR-LINE STOCK NO.	MATERIAL DESIGNATION	SPECIFICATION NUMBER	MATERIAL MANUFACTURERS REFERENCE AND/OR SPECIFICATION	SUPPLIER CODE
P11- CLEANING AGENTS					
P11-027		Solvent, Petroleum	AMS 3160, PMC 9001	P-D-680, Type II, 140°F Flash Point	LOCAL
			or		
			MIL-PRF -680 Type III	Flash Point, TCC 200° - 241°F (93° - 116°C)	
P11-031		Cleaner, Alkali	PMC 1284	Blue Gold Cleaner	S0027
P11-032		Acetone, Phenol-free	PMC 9008-1, -2,-5,-6, -7		LOCAL
			PMC 9008-3,-4	R-504	98733
Do not use P11-032 for bonding applications where reagent-grade solvent is necessary. For those applications, use P11-065.					
P11-037		Solution, Cleaning		Turco 4366	B0007
P11-038		(Deleted)			
P11-039		Solvent, Cleaner	PMC 9060	DeSo Clean 45	0NYS9
P11-040		Cleaner, Alkali	SPMC 106	Blue Gold Spray Washer	S0027

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ITEM NO.	AIR-LINE STOCK NO.	MATERIAL DESIGNATION	SPECIFICATION NUMBER	MATERIAL MANUFACTURERS REFERENCE AND/OR SPECIFICATION	SUPPLIER CODE
P11- CLEANING AGENTS					
P11-041		(Deleted)			
P11-042		Cleaner/ Remover, Fluorescent Penetrant	PMC 4366	Magnaflux SKC-S	37676
P11-043		Solvent, Methyl Isobutyl Ketone (MIBK)	PMC 9079 Technical Grade		LOCAL
P11-044		Cleaner, Aqueous (General Purpose)	SPMC 104	Cee-Bee A-7X7	71361
P11-045		Cleaner, Aqueous (General Purpose)	SPMC 105	Turco 5948 DPM	0BYN5
P11-046		(Deleted)			
P11-047		Cleaner, Aqueous Gel	SPMC 109	Turco 5948 DPM Thick	0BYN5
P11-048		Cleaner, Aqueous Gel	SPMC 110	Aviawash Green Gel	D1940 K6858 02CA7 23373

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ITEM NO.	AIR-LINE STOCK NO.	MATERIAL DESIGNATION	SPECIFICATION NUMBER	MATERIAL MANUFACTURERS REFERENCE AND/OR SPECIFICATION	SUPPLIER CODE
P11- CLEANING AGENTS					
P11-049		Cleaner, Aqueous	SPMC 148-1 SPMC 148-2 SPMC 148-3 SPMC 148-4	Turco 6780 ECO-SOLV Ardrox 6077 Window Cleaner Plus MAG-CHEM Evasol MC Spray & Wipe	0BYN5 D1940 K6858 02CA7 23373 35502 0GA37
P11-050		(Deleted)			
P11-052		Cleaner, Heavy Duty		CALLA 855	8E913
P11-053		Alkaline Gel	SPMC 135 SPMC 136 SPMC 137	Dubois AE-3003 Turco 5805 Cee-Bee Alko	72008 0BYN5 71361
P11-054		(Deleted)			
P11-055		Solvent, Cleaner	PMC 8914 PMC 8914-1: Aerosol PMC 8914-2: 1 Gallon (3.79 liter) Container	Envirosolv 655	05867

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ITEM NO.	AIR-LINE STOCK NO.	MATERIAL DESIGNATION	SPECIFICATION NUMBER	MATERIAL MANUFACTURERS REFERENCE AND/OR SPECIFICATION	SUPPLIER CODE
P11- CLEANING AGENTS					
P11-056		Solvent, Cleaner	SPMC 156	MAG-CHEM Teksol	35502
P11-057		Solvent, Cleaner	SPMC 168	Super Degreaser	023V4
P11-058		Solvent, Cleaner	SPMC 175	CE-SX-94	27674
P11-059		Solvent, Cleaner	SPMC 176	GB-SX-94	27674
P11-060		Solvent, Cleaner	SPMC 179	CRC Precision Plus Cleaner	023V4
P11-062		Solvent, Dielectric (Ultra-high Purity)	PMC 8920	Positron	8S927
P11-063		Solvent, Hand - Wiping	PMC 8917	EZE 662	89524
P11-064		Solvent, Cleaner	SPMC 185	Cynergy (L-SX-94)	27674
P11-065		Acetone	PMC 1914	(Reagent Grade, A.C.S)	LOCAL
				JT Baker 9006-05	70829

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ITEM NO.	AIR-LINE STOCK NO.	MATERIAL DESIGNATION	SPECIFICATION NUMBER	MATERIAL MANUFACTURERS REFERENCE AND/OR SPECIFICATION	SUPPLIER CODE
P11- CLEANING AGENTS					
P11-066		Solvent Hand-wiping	PMC 8929	Bioact 105, Precision Cleaner	OWUA8
P11-068		Enhancer, Electrical Contact	SPMC 205	Stabilant 22	38948
P11-069		Cleaner, Alkaline Gel	SPMC 112	Ardox 1900B	D1940 K6858 02CA7 23373
P11-070		Cleaner, Alkaline Gel	SPMC 159	McGean-Rohco Super Bee 262	71361
P11-071		Cleaner, Alkaline Gel	SPMC 113	Mag-ChemDG Kleen	35502
P11-072		Degreaser, Aqueous	SPMC 151	Nu-Gear-SC	1EYE7
P11-073		Degreaser, Aqueous	SPMC 195	Mirachem 500	63247
P11-074		Solvent, Cleaner	SPMC 213	Skysol Wipe Solvent	35502

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ITEM NO.	AIR-LINE STOCK NO.	MATERIAL DESIGNATION	SPECIFICA-TION NUMBER	MATERIAL MANUFACT-URERS REFERENCE AND/OR SPECIFIC-ATION	SUP-PLIER CODE
P11- CLEANING AGENTS					
P11-075		Wipe, Cleaner Slovent	SPMC 213-2	Skysol Wipe Solvent pre-saturated wipes	33502
P11-076		Solvent, Cleaner	SPMC 216-1	Loxotane Fast	U3115 3YAK8
P11-077		Wipe, Cleaner Solvent	SPMC 216-2	Loxotane Fastwipes	U3115 3YAK8

ITEM NO.	AIRLINE STOCK NO.	MATERIAL DESIGNATION	SPECIFICA-TION NUMBER	MATERIAL MANUFACTURERS REFERENCE AND/OR SPECIFICATION	SUPPLIER CODE
P15- STORAGE PRESERVATION					
P15-001		Dehydrating Agent		MIL-D-3464 SPMC 214	LOCAL
P15-002		Coating Peelable		AZ 534-2B	0A3C8

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ITEM NO.	AIRLINE STOCK NO.	MATERIAL DESIGNATION	SPECIFICATION NUMBER	MATERIAL MANUFACTURERS REFERENCE AND/OR SPECIFICATION	SUPPLIER CODE
P16- STRUCTURE PAINTS					
P16-001		Thinner		TL-29	98502
P16-002		Catalyst		Catalyst X-304	98502
P16-003		Base, Gloss, Black		443-3	98502

ITEM NO.	AIRLINE STOCK NO.	MATERIAL DESIGNATION	SPECIFICATION NUMBER	MATERIAL MANUFACTURERS REFERENCE AND/OR SPECIFICATION	SUPPLIER CODE
P18- PRIMER					
P18-001		Primer, Epoxy Polyamide			71191
P18-003		Primer, Zinc Chromate	TT-P-1757		LOCAL
		(Alternate to P18-023)	AMS 3110		77672
			(Alternate to AMS 3117)		
P18-007		Primer, Silicone	PWA 36086-2	Dapco No. 1-100	58093
P18-009		Primer, Silicone Rubber	PWA 556	DC 1200	71984
					98500
		(Red or Clear)			

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ITEM NO.	AIRLINE STOCK NO.	MATERIAL DESIGNATION	SPECIFICATION NUMBER	MATERIAL MANUFACTURERS REFERENCE AND/OR SPECIFICATION	SUPPLIER CODE
P18- PRIMER					
P18-011		Primer, Urethane Compatible	(Deleted)		
P18-012		Primer, Epoxy Resin		463-12-8	98502
P18-013		Primer, Epoxy, Adhesive		BR-127	07542
P18-015		Primer, Epoxy (Replaced By P18-016)		Base 463-6-27 Converter X337 Thinner TL52-66	98502
P18-016		Primer, Epoxy		Base 10P4-2	0KXA5
P18-018		Primer, Epoxy	PWA 36515	44-GN-36 (Preferred) 44-GM-54	33461
P18-020		Primer, Epoxy	PWA 36519-1	EEAE 152A/B Eco-prime	23354
			PWA 36519-2	EWAE 118A/B Eco-prime	23354
P18-023		Primer, Zinc Molybdate (Alternate to P18-003)	AMS 3117 (Alternate to AMS 3110)		LOCAL 77672

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MATERIALS AND SUPPLIERS - STANDARD PRACTICES-02

Task 70-30-00-990-002:

1. Supplier Source Code List

A. Effectivity

(1) All (727/8D, 737/8D, Super 27/8D, DC-9/8D)

B. General

(1) This list is an index of suppliers for consumable materials and for some specific equipment.

C. Supplier Code Address List

(1) The addresses of the material manufacturers are included in alphanumeric order in the table that follows.

NOTE: All SOURCE CODES, except those in the S-series, refer to CAGE (Commercial and Government Entity) codes. The present CAGE code numbers were formerly called FSCM (Federal Supply Code for Manufacturers) and FSCNM (Federal Supply Code for Non-Manufacturers) codes. The actual five-digit codes assigned to companies as FSCMs or FSCNMs have remained the same but have been redesignated as CAGE codes. All SOURCE CODES in the S-series (that is, S0001 thru S0170) are assigned by P&W to those consumable material suppliers that have no CAGE code.

Supplier Code	Name/Address
A0001	(Refer to LOCAL)
A0014	(Refer to 12861)
A0056	(Refer to S0029)
A0073	Speedry Products, Inc. - Richmond Hill, NY (Current Address Unavailable)
A0075	(Refer to S0036)
A0285	(Refer to 98500)
A0290	(Refer to 95015)

Supplier Code	Name/Address
A0292	(Refer to 97361)
B0006	(Refer to 93255)
B0007	(Refer to 71410)
B0008	Products Research & Chemical Co. - Gloucester, NJ (Current Address Unavailable)
B0009	Paul & Co. - Steinhau, Germany (Refer to S0119)
B1050	Antwerp Lion Oil Works N.V. VLAMSE KAAI 2-5 Antwerpen, Belgium
B1571	Dow Corning S.A. Parc Ind. Zone C Seneffe, Belgium
C4298	Pruftechnik Dieter Busch AG Oskar-Messter-Strasse 19 to 21 Postfach/P.O. Box 1263 D-85737 Ishmaning, Germany
D1940	Chemetall GmbH Trakehner Strasse 3 D-60487 Frankfurt am Main, Germany
EQ032	Foucault International Corp. 920 36th Court SW Vero Beach, FL 32968 USA
F6892	Socomor Finishing Technologies Zone Industrielle du Prat R. P. 3707 56037 Vannes, Cedex, France
KA832	Shell Aviation LTD Shell Centre London SE17NA, UK
K2063	Ely Chemical Co., Ltd. Lisle Lane Ely CB7 4A5, United Kingdom

Supplier Code	Name/Address
K2884	(Refer to D1940)
K6858	Chemetall Plc 65 Denbigh Road Bletchley Milton Keynes, MK1 1PB, Unied Kingtom
LOCAL	Local Purchase
S0001	(Refer to Service Bulletin SB 238)
S0004	(Refer to 86874)
S0005	(Deleted)
S0006	(Refer to S9502)
S0007	(Refer to 08FS3)
S0008	(Refer to 0XB37)
S0025	(Refer to 1A319)
S0027	(Refer to 0GA37)
S0029	National Tape Corp. 5140 Storey Street New Orleans, LA 70123-5320 USA
S0036	Texrite Products Co. 10333 Shoemaker Street Detroit, MI 48213 USA
S0045	(Refer to 23037(D))
S0055	Mosher Co., Inc. 15 Exchange Street Chicopee, MA 01014 USA or P. O. Box 177 Chicopee, MA 01014-0177 USA
S0057	(Refer to 05972)
S0066	(Refer to B1571)

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	Supplier Code	Name/Address
	S0075	(Refer to 1TGF9)
	S0076	(Refer to OJWE8)
	S0077	(Refer to 35502)
	S0078	(Refer to 23373)
	S0083	(Refer to 1M647)
	S0092	(Deleted)
R	S0099	(Refer to 38XJ0)
	S0101	Power in Motion 16A Montesano Road Fairfield, NJ 07004 USA
	S0113	(Refer to 0V0Z6)
	S0117	Rhodia VSI (Was: Rhone-Poulenc Silicone VSI) 405 Jordan Road Troy, NY 12180 USA
	S0118	G. K. D. Kufferath & Co. P. O. Box 101155 Metallweberstrasse 46 5160 Duren, Germany
	S0119	Paul GmbH & Co. P. O. Box 1228 Industriegebiet West 36396 Steinau an der Strasse Germany
	S0126	Eishin Kagaku Co., Ltd. 1-2-13, Higashi-Shinbashi Minato-Ku Tokyo, Japan-105
	S0141	ECT, Inc. Bridgeport Business Park 401 East 4th St., Building 20 Bridgeport, PA 19405 USA

Supplier Code	Name/Address
S0144	Carco, Inc. P. O. Box 13859 10333 Shoemaker Street Detroit, MI 48213 USA
S0150	(Refer to 70362)
S0156	(Refer to 1ZC62)
S0163	Polyflow, Inc. 100 Pratt's Junction Road Sterling, MA 01564 USA
S0170	Turbo-K, Ltd. 31 Meadow Close London Colney AL2 1RH, England
S0171	Sefar America Inc. 333 South Highland Avenue Briarcliff Manor, N.Y. USA
S0172	G. Bopp & Company AG Bachmannweg 20 CH -8046 Zurich, Switzerland
S0176	Tyco Adhesives, A Tyco International Ltd. Co. 1400 Providence Highway Norwood, MA 02062-5044 USA
S0178	(Refer to K6858)
S0190	Gerard Daniel Worldwide - Europe Mountmahon Industrial Estate Abbeyfeale, Limerick, Ireland
S0202	Shurtape Technologies LLC 1506 Highland Avenue NE Hickory, NC 28601 USA
S0207	ITW Texwipe 300 B Route 17 South Mahwah, NJ07430 USA

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Supplier Code	Name/Address
S0210	Telesto Industrie, LLC 3718 Highway 90 Liberty, TX 77575
S0212	Sonneborn, LLC 575 Corporate Drive Suite 415 Mahwah, NJ 07430 USA
S0213	Aviation Fluids Services, Inc. 950 Kingsland Avenue St. Louis, MO 63130 USA
S0214	C-E Minerals 901 East 8th Avenue King of Prussia, PA 19406 USA
S0216	Momentive Performance Materials, Inc. 187 Danbury Road Wilton, CT 06897 USA
S0226	JacksonLea (A Unit of Jason, INC.) 1715 E. Conover Boulevard Conover, NC 28613 USA
S9502	Marktec Corp. 3-10, Sanno 2-Chome OHTA-KU Tokyo, Japan
U0638	(Refer to S0203)
U3115	Arrow Chemicals, Ltd. Div. of Reabrook, Ltd. Rawdon Road Moira, Swadlincote, Derbyshire, UK DE12 6DA
U4628	Airworthy, Ltd. Elsted Station Elsted, Midhurst West Sussex, GU29 0JT United Kingdom

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Supplier Code	Name/Address
00BB6	Indestructible Paint Inc. 66 Erna Avenue Midford, CT 06460-3115 USA
0AH54	(Deleted)
0AL61	EMD Chemicals, Inc. 480 Democrat Road Gibbstown, NJ 08027 USA
0A341	Strahl And Pitsch, Inc. 230 Great E. Neck Road P. O. Box 1098 West Babylon, NY 11704 USA
0A3C8	AZTEC Chemical Inc. 10770 Lower Azusa Road El Monte, CA 91731 USA
0A9Y2	Cantech Industries Inc. 2222 Eddie Williams Road Johnson City, TN 37601 USA
0BYN5	(Refer to 71410)
0ER09	American Marking Systems, Inc Harrisburg Stamp Company Division 2741 Paxton Street Harrisburg, PA 17111 USA
0EWP0	Garvey 871 Redna Terrace Cincinnati, OH 45215 USA
0GA37	Modern Chemical Inc. 7023 Centennial Road P. O. Box 368 Jacksonville, AR 72078 USA
0JWE8	Adchem, Inc. 369 Progress Drive, Suite 101 Manchester, CT 06040-2296 USA
0JYZ0	SCI Corporation 812 East Broadway Streator, IL 61364 USA

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Supplier Code	Name/Address
0KX05	Bayside Industrial Supply, Inc. 4663 Halls Mill Road P. O. Box 91566 Mobile, AL 36691 USA
0NYS9	(Refer to 23354)
0PGK2	S D B Consultants LTD 401 Whitney Avenue, Suite 120 Gretna, LA 70056-2500 USA
0V0Z6	Videojet Technologies, Inc. (Was Marconi Data Systems, Inc.) 1500 Mittel Boulevard Wood Dale, IL 60191-1073 USA
0WU71	Ecolink, Inc. (Was: Div. of Sentry Chemical Co., Inc.) 1481 Rock Mountain Boulevard Stone Mountain, GA 30083-1505 USA
OW199	The Sherwin-Williams Company 2390 Arbor Boulevard Dayton, OH 45439 USA
00BA9	Penreco, Div. of Pennzoil - Quaker State Co. 138 Petrolia Street Karns City, PA 16041-9799 USA
00BB6	Indestructible Paint, Inc. 1 Independence Drive Monroe, CT 06468 USA
00046	(Deleted. Refer to 0ER09)
00741	BOC Gases (Was: Airco Industrial Gases, Div. of The BOC Group) 575 Mountain Avenue New Providence, NJ 07974-2097 USA
00768	Western Filament, Inc. 630 Hollingsworth Street Grand Junction, CO 81505 USA

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Supplier Code	Name/Address
01058	Michigan Chrome & Chemical Co. 8615 Grinnell Street Detroit, MI 48213-1152 USA
01139	Momentive Performance Materials, Inc. (Bought out General Electric Co., Rubber & Fluid Products Dept.) 260 Hudson River Road Waterford, NY 12188 USA
01139(A)	(Sold. Refer to 01139)
01139(B)	(Sold. Refer to S0216)
012L8	Chemsol Inc. 8423 Boettner Road Bridgewater, MI 48115 USA
02CA7	Chemetall Oakite (Was: Oakite Products, Inc.) 50 Valley Road Berkeley Heights, NJ 07922 USA
02SG7	Octel America, Inc. 200 Executive Drive Newark, DE 19702 USA
02ZK3	(Refer to 1NCU0)
023V4	CRC Industries, Inc. 885 Louis Drive Warminster, PA 18974 USA
02570	Swagelok Co. 29500 Solon Road Solon, OH 44139-3492 USA
02697	Parker-Hannifin Corp., O-Ring Div. 2360 Palumbo Drive P. O. Box 11751 Lexington, KY 40512-1751 USA
03042	(Refer to 16956)

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Supplier Code	Name/Address
03530	American Gas & Chemical Co., Ltd. 220 Pegasus Avenue Northvale, NJ 07647-1904 USA
04457	Mark-Tex Corp. 160 West Forest Avenue Englewood, NJ 07639 USA
04552	Emerson & Cuming Specialty Polymers (Was: Grace W. R. and Co. Emerson and Cuming, Dewey and Almy Chemical Div.) 869 Washington Street Canton, MA 02021-2513 USA
04621	Hexcel Corp. 2350 Airport Fwy., Suite 550 Bedford, TX 76022-6027 USA
04622	CYTEC Engineered Materials, Inc. (Was: BASF Corp.) 1440 N. Kraemer Blvd. Anaheim, CA 92806 USA
047D8	Zyvax, Inc. 1388 NW 2nd Avenue Suite 5 P. O. Box 825 Boca Raton, FL 33429-0825 USA
04963	3M Company, Tape And Specialties Div. 3M Center, Bldg. 220-7E-01 St. Paul, MN 55144-1000 USA
05045	The BG Service Co., Inc. 1400 Alabama Avenue - Suite 15 P. O. Box 2259 West Palm Beach, FL 33401 USA
05160	(Refer to S0190)
05867	Fine Organics Corp. 205 Main Street P. O. Box 687 Lodi, NJ 07644-0687 USA

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Supplier Code	Name/Address
05972	Henkel Loctite Corp. (Was: Loctite Corp.; Permatex Industrial Div. Of Loctite North America Group; and, Loctite VSI, Inc.) 1001 Trout Brook Crossing Rocky Hill, CT 06067-3582 USA
06565	Norton Co., (for domestic orders) Coated Abrasive Div. Tenth Avenue & 25th Street Watervliet, NY 12189 USA
07096	Burke Industries (Was: Burke Rubber Co., Purosil Div. 13767 Freeway Drive Santa Fe Springs, CA 90670 USA
07098	Praxair - Industrial Gases (Was: Union Carbide Corp., Linde Div.) 175 E. Park Drive P. O. Box 44 Tonawanda, NY 14151-0044 USA
07099	Flexfab Molded Products (Was: Moxness Molded Products; and, Moxness Products, Inc.) 2030 Young Street East Troy, WI 53120 USA
07314	Fiberite Corp. - Winona, MN (Obsolete)
07512	Saint-Gobain Performance Plastics 150 Dey Road Wayne, NJ 07470 USA
07542	CYTEC Engineering Materials (Was: CYTEC Fiberite, Inc.; and, American Cyanimide Co., Industrial Chemical and Plastics Div./Bloomingdale Dept.) 1300 Revolution Street Havre De Grace, MD 21078-3800 USA

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Supplier Code	Name/Address
07696	Kodak Canada, Ltd. 3500 Eglinton Avenue W Toronto M6M 1V3, Canada
07950	Anderol, Inc. (Was: Royal Lubricants Co., Inc.) 215 Merry Lane P. O. Box 518 E. Hanover, NJ 07936-0518 USA
08FS3	Vulcan Chemical Technologies (Was: Vulcan Chemicals, Div. of Vulcan Materials Co.) 1200 Urban Center Drive Birmingham, AL 35242 USA
09785	AGA Gas, Inc. 3300 Lakeside Avenue Cleveland, OH 44114-3751 USA
1A053	AAA Aircraft Supply Co. 36 Suffield Street P. O. Box 411 Windsor Locks, CT 06096-1320 USA
1CXA3	Sefar America Inc. 111 Calumet Street Depew, New York 14043-3734 USA
1DWR5	Advanced Chemistry & Technology, Inc. 7341 Anaconda Avenue Garden Grove, CA 92841-2921 USA
1E1X8	Saint-Gobain Ceramics & Plastics, Inc. (DBA Saint-Gobain Ceramic Materials) 1 Bond Street P. O. Box 15137 Worcester, MA 01615-0137 USA
1EYE7	Nuvite Chemical Compounds 213 Freeman Street Brooklyn, NY 11222-1404 USA
1HX90	Brand-Nu Laboratories Inc. 377 Research Parkway Meriden, CT 06450-7155

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Supplier Code	Name/Address
1KGE8	Fisher Scientific Company Global Exports 3970 Johns Creek Court, Suite 500 Suwanee, GA 30024-1297 USA
1KU10	Cytec Engineered Materials Inc 1300 Revolution Street Havre De Grace, MD 21078-3800 USA
1ML15	Octel Starreon, LLC 8375 S. Willow Street - 5th Floor Littleton, CO 80124 USA
1M647	Fuchs Lubricants Co. 281 Silver Sands Road P. O. Box 328 East Haven, CT 06512-4140 USA
1NCU0	Zokman Products, Inc. 1220 E. Gump Road Fort Wayne, IN 46845-9794 USA
1PWD8	Exxon Mobil Corp. 3225 Gallows Road - Room 4W917 Fairfax, VA 22037 USA
1TGF9	Ohio Industrial Lubricants, Inc. 250 Mahoning Avenue Cleveland, OH 44113 USA
1UGB2	Air BP Lubricants Division of BP Products North America Inc. Parsippany, NJ 07054-4406 USA
1VJW7	Intertape Polymer Management Corp. 3647 Cortez Road West Bradenton, FL 34210-3169 USA
1V074	Sulflo, Inc. 1158 Erie Avenue North Tonawanda, NY 14120-3507 USA
1XNT8	D Aircraft Products 1191 N. Hawk Circle Anaheim, CA 92807 USA

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Supplier Code	Name/Address
1ZC62	Valco Cincinnati, Inc. (Was: W. Canning, Inc.) 411 Circle Freeway Drive Cincinnati, OH 45246 USA
10009	RM Engineered Products, Inc. - North Charleston, SC (Current Address Unavailable)
11770	(Refer to 8F024)
11851	Daniels Manufacturing Corp. 526 Thorpe Road Orlando, FL 32824-8133 USA
12474	Bel-Ray Co., Inc. 1201 Bowan Avenue Wall, NJ 07719 USA
12861	Intertape Polymer Group, Inc. (Was: Armak Co., Tape Div.) 317 Kendall Avenue Marysville, MI 48040-1911 USA
13868	Kano Laboratories, Inc. 1000 Thompson Lane Nashville, TN 37211-4101 USA
15653	Fairchild Fasteners - Fullerton Operations (Was: Kaynar Manufacturing Co.) 800 S. State College Blvd. Fullerton, CA 92831-3004 USA
16193	(Obsolete)
16837	Miracle Power Products Corp. 1101 Belt Line Street Cleveland, OH 44109-2849 USA
16956	Avery Dennison (For Orders) (Was: Dennison Mfg. Co., Identification Systems Div.) 50 Pointe Drive Brea, CA 92821-3699 USA

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Supplier Code	Name/Address
17125	(Deleted)
17209	(Deleted)
17534	Alconox, Inc. (Was: Standard Scientific Supply Co.) 30 Glenn Street Suite 309 White Plains, NY 10603 USA
17699	Weiler Brush Co. 1 Wildwood Drive RD 1 P. O. Box 149 Cresco, PA 18326 USA
18034	(Refer to 02570)
18598	Miller-Stephenson Chemical Co., Inc. 55 Backus Avenue Danbury, CT 06813 USA
18873	E. I. duPont de Nemours and Co. Inc. 1007 Market Street P. O. Box 1635 Wilmington, DE 19899 USA
19135	Mobil Oil Co. Interstate 10 P. O. Box 3311 Beaumont, TX 77704 USA
19354	Daniel Gerard & Co., Ltd. 5 Plain Avenue New Rochelle, NY 10801-2204 USA
2A851	John R. Lyman Co. 60 Depot Street Chicopee, MA 01013-1251 USA
2B975	Hexcel Corp. 1913 N. King Street Seguin, TX 78155-2115 USA
2G152	(Deleted)

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Supplier Code	Name/Address
2M749	SKF Industries, Inc. Bearing Group 1100 1st Avenue King of Prussia, PA 19406 USA
2R128	Castrol Industrial Americas (Was: Castrol Industrial North America Div. of Endurance Technology) 1001 West 31st Street Downers Grove, IL 60515-5509 USA
20696	Maryland Brush Co. 3221 Frederick Avenue Baltimore, MD 21229-3807 USA
21361	B & B Tritech, Inc. (Was: B & B Chemical Co., Inc.) 875 West 20th Street Hialeah, FL 33010-2310 USA
21405	Sherwin, Inc. 5530 Borwick Avenue South Gate, CA 90280-7402 USA
22527	Fisher Scientific Co. 2000 Park Lane Pittsburgh, PA 15275 USA
22819	Aviall Services, Inc. 2750 Regent Boulevard Dallas, TX 75261-9048 USA
22873	(Refer to 23354)
23037(A)	E. I. duPont de Nemours Co., Inc. Chemical And Pigments Dept. 1007 Market Street Wilmington, DE 19898 USA
23037(D)	E. I. duPont de Nemours Co., Inc. Fabrics & Finishes Dept. 1007 Market Street Wilmington, DE 19898 USA

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Supplier Code	Name/Address
23354	PRC-DeSoto International, Inc. PPG Aerospace Div. 823 East Gate Drive, Unit 4 Mount Laurel, NJ 08054-1202 USA
23373	Chemetall Oakite 16961 Knott Avenue La Mirada, CA 90638-6015 USA
24269	Schaefer Machine Co., Inc. 200 Commercial Drive Deep River, CT 06417 USA
26057	TAFA, Inc. 146 Pembroke Road Concord, NH 03301-5706 USA
26066	Minnesota Mining & Mfg. Co., Industrial Tape Div. (Obsolete. Refer to 04963)
27674	(Refer to 86938)
27732	Ensign Products Co., Inc. 3528 East 76th Street Cleveland, OH 44105-1510 USA
28112	Minnesota Mining and Mfg. Co., Performance Materials Div. (Was: Performance Chemicals & Fluid; and, Industrial Chemical Products Div.) 3M Center Building 223-06-S-04 St. Paul, MN 55144-0001 USA
28124	3M Co., Abrasive Systems Div. 3M Center, Building 0223-06-N-01 Saint Paul, MN 55144-1000 USA
28139	(Refer to 92469)
28506	(Refer to 00741)
29700	(Refer to 1PWD8)

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Supplier Code	Name/Address
3A487	(Refer To 97361)
3DYZ1	Crompton Corp. (Was: Witco/A Crompton Business) 1 American Lane Greenwich, CT 06831 USA
3EU06	Intertape Polymer Group Inc. DBA American Tape 317 Kendall Avenue Marysville, MI 48040-1911 USA
3F733	Cabot Corp., Cab-O-Sil Div. 700 East U. S. Highway 36 Tuscola, IL 61953 USA
3FBZ6	Hexion Specialty Chemicals, Inc. Division of Epoxy & Phenolic Resins 1600 Smith Street, Floor 24 Houston, TX 77002-7362 USA
3FJ16	Echo Engineering & Production Supplies Inc. (DBA Echo Supply) 5406 W 78th Street Indianapolis, IN 46268-4149 USA
3TYN6	CS Hyde Company, Inc. 1351 N Milwaukee Avenue Lake Villa, Illinois 60046 USA
3YAK8	Atlanco, Inc. No. 2 Bomar Street Inman, SC 29349 USA
30479	Van Straaten Chemical Co. 149 Grant Street P. O. Box 227 North Aurora, IL 60542-1603 USA
30530	Safety-Kleen Corp. 1301 Gervais Street - Suite 300 Columbia, SC 29201 USA

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Supplier Code	Name/Address
30676	Lord Corp., Chemical Products Div. 2000 W. Grandview Boulevard Erie, PA 16514-0038 USA
32988	(Refer to S0163)
33461	Deft, Inc. 17451 Von Karmen Avenue Irvine, CA 92614 USA
33564	Henkel Loctite Corp. (Was: Dexter Corp. Dexter Adhesive & Coating Systems) P. O. Box 312 2850 Willow Pass Road Bay Point, CA 94565-0031 USA
33629	The Kindt-Collins Co. 12651 Elmwood Avenue Cleveland, OH 44111-5911 USA
33684	Stanley Home Products, Inc. Industrial Div. 116 Pleasant Street East Hampton, MA 01027-1118 USA
34227	Sandstrom Products Co. 224 South Main Street Port Byron, IL 61275 USA
34568	Tiodize Co., Inc. 5858 Engineer Drive Huntington Beach, CA 92649 USA
34897	Ashland Chemical Co., A Div. of Ashland Oil, Inc. P. O. Box 2219 Columbus, OH 43216-2219 USA
35502	Magnus Chemicals, Ltd. (Was: Mag-Chem, Inc.) 1271 Ampere Boucherville, Quebec, Canada J4B 5Z5
36023	(Refer to 19354)

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Supplier Code	Name/Address
36346	Praxair - Industrial Gases (Was: Union Carbide Corp., Linde Div.) Old Ridgebury Road Danbury, CT 06817 USA
37676	Magnaflux Corp., Div. Of Illinois Tool Works, Inc. 3624 W. Lake Avenue Glenview, IL 60025 USA
37995	Burmah-Castrol Canada Ltd. 3660 Lakeshore Boulevard W. Toronto, Ontario, Canada M8W 1P2
38XJ0	Tesa Tape, Inc. 5825 Carnegie Boulevard Charlotte, NC 28209 USA
38597	Lockheed Martin Corp. (Was: Martin Marietta Corp. Aero And Naval Systems) 2323 Eastern Boulevard E-5 Baltimore, MD 21220-4207 USA
38948	D. W. Electrochemicals, Ltd. 3-97 Newkirk Road (North), Richmond Hill, Ontario L4C 3G4 Canada
39428	McMaster-Carr Supply Co. 600 County Line Road Elmhurst, IL 60126-2034 USA
4G117	BGF Industries, Inc. 401 Amherst Avenue P. O. Box 592 Altavista, VA 24517 USA
4N020	CCP Industries, Inc. (Was: Cleveland Cotton Products Co.) 670 Alpha Drive Highland Heights, OH 44143 USA

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Supplier Code	Name/Address
4PNW1	Rubber Stamps Unlimited, Inc. 334 South Harvey Plymouth, MI 48170 USA
44197	(Refer to 1E1X8)
44926	Olympic Glove and Safety Company 75 Main Avenue Elmwood Park, NJ 07407 USA
45255	Owens-Corning Fiberglas Corp. Fiberglas Tower - T/11 One Owens Corning Parkway Toledo, OH 43659-0001 USA
45681	Parker Hannifin Corp. 6035 Parkland Boulevard Mayfield Heights, OH 44124 USA
47695	PPG Industries, Inc. Chemical Group One PPG Place Pittsburgh, PA 15272-0001 USA
5D028	Dow Corning Corp. 3901 South Saginaw Road Midland, MI 48640 USA
5R603	Merco Company 205 Lee Place Hackensack, NJ 07601-3304 USA
5W425	Bostik, Inc. 211 Boston Street Middleton, MA 01949 USA
5Y661	Shurtape Technologies, Inc. (Was: Shuford Mills, Inc. Tape Div.) 1620 Highland Avenue P. O. Box 1530 Hickory, NC 28603-1530 USA
50744	Kirkhill-TA Company (DBA SFS Division) 300 E Cypress Street Bea, CA 92821-4007 USA

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Supplier Code	Name/Address
52152	Minnesota Mining And Mfg. Co., Industrial Tape And Specialties Div. 3M Center St. Paul, MN 55144-1000 USA
53012	Coatings for Industry, Inc. 319 Township Line Road Souderton, PA 18964-1905
53100	Lockheed Martin Space Systems Co. - Michoud Operations (Was: Lockheed Martin Corp.; and, Martin Marietta Corp.) 13800 Old Gentilly Road - MS 2300 P. O. Box 29304 New Orleans, LA 70129-2218 USA
53912	Airtech International, Inc. 5700 Skylab Road Huntington Beach, CA 92647-2055 USA
54527	Shell Oil Company 1 Shell Plaza P. O. Box 2463 Houston, TX 77001 USA
54636	The Sherwin-Williams Co., Krylon Products Group 101 Prospect Street Cleveland, OH 44115 USA
54916	Radiac Abrasives, Inc. 1015 South College Avenue Salem, IL 62881-2428 USA
55596	Polymet Corp. 10073 Commerce Park Drive Cincinnati, OH 45246-1333 USA
56385	Ultrachem 900 Centerpoint Boulevard Newcastle, DE 19720 USA
56883	Penetone Corp. 74 Hudson Avenue Tenafly, NJ 07670 USA

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Supplier Code	Name/Address
57635	(Refer to 1PWD8)
58093	(Refer to 1XNT8)
58401	U.S. Welding 3579 Highway 50 East Carson City, NV 89701 USA
58595	Pilot Corp. of America 60 Commerce Drive Trumbull, CT 06611 USA
58913	Sermatech International, Inc. 155 S. Limerick Road Limerick, PA 19468-1699 USA
59460	Pyramid Plastics, Inc. Tolber Div. 220 West 5th Street Hope, AR 71801-5212 USA Tel: (870) 722-5739 Fax: (870) 777-8056
6A670	3M, ITSD Aerospace (Was: Adhesives, Coatings & Sealers Div.) 3211 E. Chestnut Expressway P. O. Box 300 M Springfield, MO 65802-2548 USA
60218	Graphite Products Corp. 5756 Sharon-Warren Road P. O. Box 207 Brookfield, OH 44403-9507 USA
60890	Dewal Industries, Inc. 15 Ray Trainor Drive P. O. Box 372 Saunderstown, RI 02874 USA
61637	Danbury Union Carbide Corp. 39 Old Ridgebury Road Danbury, CT 06817-0001 USA

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Supplier Code	Name/Address
62369	Flexcon Co., Inc. 1 Flexcon Industrial Park Spencer, MA 01562 USA
62758	(Refer to 23354)
63247	Mirachem Corp. 4645 McDowell Road - Unit 103 Phoenix, AZ 85035 USA
64220	Ruger Chemical Co., Inc. 83 Cordier Street Irvington, NJ 07111-4035 USA
65483	(Deleted. Current address not available.)
66442	Richmond Aircraft Products 13503 Pumice Street Norwalk, CA 90650 USA
66724	LPS Laboratories, Inc. 4647 Hugh Howell Road Tucker, GA 30085-5052 USA
70079	Acheson Colloids Co., Div. of Acheson Industries, Inc. 1600 Washington Avenue P. O. Box 611747 Port Huron, MI 48061-1747 USA
70362	Dixon Ticonderoga Co. (World Headquarters) 195 International Parkway Heathrow, FL 32746 USA
70752	(Deleted)
70829	Mallinckrodt Baker Inc. 222 Red School Lane Phillipsburg, NJ 08865-2219 USA
70958	Bergen Cable Technologies, Inc. 343 Kaplan Drive Fairfield, NJ 07004 USA

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Supplier Code	Name/Address
71191	Kop-Coat, Inc. 5431 District Boulevard Los Angeles, CA 90040 USA
71361	McGean (Was: McGean, Cee-Bee Aviation Products; and, McGean-Rohco, Inc./ Cee-Bee Chemical Div.) 2910 Harvard Avenue Cleveland, OH 44105-3010 USA
71410	Henkel Aerospace Div. of Henkel Technologies, Surface Treatments 32100 Stephenson Highway Madison Heights, MI 48071 USA
71643	Saint-Gobain Performance Plastics, Inc. (Was: CHR Industries, Inc. An Armco Co.) 407 East Street New Haven, CT 06511 USA
71984	Dow Corning Corp. 2200 West Salzburg Road Midland, MI 48640-8531 USA
72008	(Deleted)
73165	(Refer to 05972)
73168	Kidde - Fenwal (Was: Fenwal, Inc. Div. of Kidde, Inc.) 400 Main Street Ashland, MA 01721-2150 USA
73219	Fiske Brothers Refining Co. 129 Lockwood Street Newark, NJ 07105-4720 USA

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Supplier Code	Name/Address
73277	Houghton International, Inc. (Was: E. F. Houghton & Co.) P. O. Box 930 Madison & VanBuren Avenues Valley Forge, PA 19482 USA
74230	FMI Paint & Chemicals (Was: FMI Chemical Corp.) 158 Hartford Road Manchester, CT 06040 USA
74291	Solo-Horton Brushes, Inc. 122 Summer Street Torrington, CT 06780 USA
75273	Witco Chemical Corp. Kendall/Amalie Motor Oil (Was: Kendall Refining Co. Div. of WITCO Chemical Co.) 77 N. Kendall Avenue P. O. Box 2000 Bradford, PA 16701-1726 USA
75364	(Deleted. Only sells to distributors. Refer to local art supply for source.)
75437	EOE, Inc. 585 Fourth Street P. O. Box 177 Troy, NY 12181 USA
75554	(Deleted. Use S0226)
75668	Sherwin-Williams Co. 2390 Arbor Boulevard Dayton, OH 45439 USA
75957	LUDECA Inc. 1527 NW 89th Street Miami, FL 33172 USA
76071	MacDermid, Inc. 245 Freight Street Waterbury, CT 06702-1802 USA

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Supplier Code	Name/Address
76381	3M Company 3M Center - Building 225-3S-20 St. Paul, MN 55144-1000 USA
76541	Monsanto Co. 800 N. Lindbergh Boulevard St. Louis, MO 63167 USA
77163	(Refer To 1V074)
77359	(Refer to 75668)
77445	United Technologies Corp. Pratt & Whitney Large Comercial Engines, Spare Parts Sales 400 Main Street East Hartford, CT 06108-0969 USA
77490	Quaker Chemical Corp. One Quaker Park 901 Hector Street Conshohocken, PA 19428-0809 USA
77672	Randolph Products Co. Inc. 33 Haynes Circle Chicopee, MA 01020 USA
77988	(Deleted)
78369	(Refer to 3DYZ1)
78520	Stanchem, Inc. 401 Berlin Street East Berlin, CT 06023 USA
8E913	Zip-Chem Products 408 Pickering Drive Pinkerington OH 43147-1367 USA
8F024	Everlube Products, (Was: E/M Co.) Div. of Morgan Advanced Ceramics 100 Cooper Circle Peachtree City, GA 30269-3025 USA

Supplier Code	Name/Address
8S927	(Refer to 0WU71)
80769	Polyken Technologies, A Div. of The Kendall Co. (Was: The Kendall Co., Polyken Div.) 15 Hampshire Street Mansfield, MA 02048 USA
80798	(Refer to 3F733)
80861	International Paper One Penn Plaza - Suite 2814 New York, NY 10119 USA
82110	Gudebrod, Inc. 274 Shoemaker Road Pottstown, PA 19464 USA
82726	(Deleted)
83309	Electrical Specialty Co. - South San Francisco, CA (Current Address Unavailable)
83334	Tuck Industries, Inc. - New Rochelle, NY (Current Address Unavailable)
84063	(Refer to 71410)
84163	Borden, Inc. Chemical Div. 180 East Broad Street Columbus, OH 43215-3705 USA
85419	Binney and Smith, Inc. 1100 Church Lane P. O. Box 431 Easton, PA 18042-9010 USA
85570	(Refer to 23354)
86297	Cratex Manufacturing Co., Inc. 328 Encinitas Blvd. - Suite 200 Encinitas, CA 92024 USA

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Supplier Code	Name/Address
86459	(Refer to 00BA9)
86460	Elf Atochem North America, Inc. 2000 Market Street Philadelphia, PA 19103-3222 USA
86874	Sanford Corp. 2711 Washington Boulevard Bellwood, IL 60104 USA
86938	Selig Industries 1420 Seaboard Industrial Boulevard Atlanta, GA 30318 USA
87187	(Refer to 84163)
88303	Phillips Process Co., Inc. 20 Magnolia Street Rochester, NY 14608-2931 USA
88597	Volger's Ink Manufacturers (Out of Business)
89524	Ondeo Nalco Co. 1 Ondeo Nalco Center Naperville, IL 60563-1198 USA
9A090	DuPont Company Electronics Department U. S. Route 23, South & DuPont Road P. O. Box 89 Circleville, OH 43113 USA
9X057	Technical Laminations & Coatings (Was: Custom Tapes, Inc.) 7125 Gunnison Street Harwood Heights, IL 60656-3830 USA
91342	AKZO Nobel Aerospace Coatings, Inc. (Was: Dexter Specialty Coatings) 1 E. Water Street Waukegan, IL 60085-5652 USA

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Supplier Code	Name/Address
92108	PRC-Desoto International Inc. (Aerospace) 5454 San Fernando Road P. O. Box 1800 Glendale, CA 91209 USA
92469	Unilever Home Products & Personal Care (Was: Chesebrough-Ponds, Inc.) 33 Benedict Place Greenwich, CT 06830-5339 USA
94129	Brookfield Wire Co. Route 9 - P. O. Box 248 Brookfield, MA 01506 USA
94480	(Deleted. Refer to 1KGE8)
94548	Chevron Chemical Co., Agriculture Chemical Div. 575 Market Street San Francisco, CA 94119 USA
94853	The Hubbard-Hall Chemical Co. 563 South Leonard Street P. O. Box 790 Waterbury, CT 06708 USA
95015	Marvel Oil Co., Inc. 331-337 N. Main Street Port Chester, NY 10573-3305 USA
95643	(Deleted)
96717	Dow Chemical Co. 2030 Willard H. Dow Center Midland, MI 48674-0001 USA
97361	Unisource & Alco Standard Co. (Was: Chatfield Paper Co.) 21 Dodge Avenue North Haven, CT 06473 USA OR (Was: Rourke-Eno Paper Co.) 100 Helmsford Way Windsor, CT 06095-0740 USA

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Supplier Code	Name/Address
97460	(Refer to 23354)
97854	(Deleted)
98079	CVC Products, Inc. 525 Lee Road Rochester, NY 14606-4236 USA
98148	ITW Dykem 805 East Old 56 Highway Olathe, KS 66061 USA
98500	AGC, Inc. 106 Evansville Avenue Meriden, CT 06450-5135 USA
98502	Akzo Coatings, Inc. Aerospace Finishes Div. 434 W. Meats Street Orange, CA 92665 USA
98733	Met-L-Chek Co. 1639 Euclid Street Santa Monica, CA 90404-3723 USA
99251	Bendix Corp., Instrument and Life Support Div. 2734 Hickory Grove Road P. O. Box 4508 Davenport, IA 52808 USA
99384	Huntsman Advanced Materials Americas, Inc. (Was: Vantico, Inc.) 5121 San Fernando Road West Los Angeles, CA 90039-1071 USA
99742	Permacel Nitto Denko Co. (Was: Permacel, Div. Of Nitto Denko America; and, Permacel, Div. of Johnson & Johnson) U. S. Highway 1 P. O. Box 671 New Brunswick, NJ 08903 USA

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Supplier Code	Name/Address
99891	Products Research and Chemical Corp. 5430 San Fernando Road Glendale, CA 91203 USA

Task 70-71-00-300-001:

1. Cable Stainless Steel Wire Braid Repair

A. Effectivity

(1) All (727/8D, 737/8D, Super 27/8D, DC-9/8D)

B. Reason for the Task

(1) Use this repair for electrical cable wire braid covering which is worn, broken, cut, or otherwise damaged.

C. Job Set-up Information

(1) Fixtures, Tools, Test and Support Equipment

REFERENCE	DESIGNATION
No specific	Jeweler's Snips (Wiss Mo. J7 or equivalent)

(2) Consumable Materials

NOTE: The P- numbers in this list are used by other Pratt & Whitney engine programs and are included to keep this list common with other engine and airframe programs.

REFERENCE	DESIGNATION
No specific	Tinned Copper Grounding Strap
Material No. P05-111	Fiberglass Insulating Tape (Scotch 69) or equivalent)
R Material No. P05-289	Lockwire (AS3214-02)
Material No. P05-332	Lockwire (MS9226-04)

(3) Referenced Information

REFERENCE	DESIGNATION
70-30-00-910-801	List of Materials (Consumable Materials)

D. Job Set-up

(1) Not Applicable.

WIRING - CABLE STAINLESS STEEL WIRE BRAID REPAIR - REPAIR-01

E. General

WARNING: DO NOT USE HEAT GUNS, SOLDERING GUNS OR SOLDERING IRONS FOR THE ON-WING REPAIRS. THEY ARE NOT RESISTANT TO EXPLOSION AND CAN CAUSE INJURY TO PERSONS OR DAMAGE TO EQUIPMENT.

(1) Standard equipment and consumable materials can be replaced with equivalent items.

(2) Always obey the specific procedures and limits in the specific AMM maintenance tasks.

F. Procedure
See Figure 801.

NOTE: The number steps in this procedure are the same as the number steps in the figure.

(1) Prepare the damaged area as follows.

(a) Use jeweler's snips (Wiss No. J7 or equivalent) to carefully cut the steel braid around the circumference at damaged area.

(b) Move the two sections of braid apart.

(2) Install the ground strap across the damaged area as follows.

(a) Put two layers of Fiberglass Tape (Material No. P05-111) (or equivalent) around the wire bundle in damaged area.

(b) Put a piece of tinned copper ground strap across the taped area under the braid.

(c) Push the ends of braid over the ground strap and as close together as possible.

(3) Put two layers of Fiberglass Tape (Material No. P05-111) (or equivalent) around the cable over the braid, 0.250 inch (6.35 mm) from the end of the braid ends on each side of the cut.

(4) Fold the braid ends and install more tape as follows.

(a) Carefully fold the braid back over the tape.

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CAUTION: BE SURE ALL LOOSE WIRE BRAID ENDS ARE CAREFULLY FOLDED BACK OVER THE TAPE. IF THERE IS ANY PENETRATION BY THE WIRE BRAID INTO THE INSULATION AND WIRES, MALFUNCTION OF THE CABLE CAN OCCUR.

(b) Put two layers of Fiberglass Tape (Material No. P05-111) (or equivalent) around the cable over the braid ends, on each side of the cut.

(5) Apply more tape as follows.

(a) Put enough layers of Fiberglass Tape (Material No. P05-111) (or equivalent) between the braid ends so that the repair area has the same diameter.

(b) Put two more layers of Fiberglass Tape (Material No. P05-111) (or equivalent) around the cable over the entire repair area.

R (6) Install safety wire (lockwire) over the repair area as
R follows.

R (a) Wrap the repair area with Lockwire (Material No.
R P05-289 or P05-332) as shown in the figure.

(b) Cut enough wire and loop one end.

(c) Hold the wire snugly against the cable braid to left.

(d) Start at the opposite end and tightly and evenly wrap the wire over the cable braid and the repaired area.

NOTE: Be sure that wire overlaps fiberglass insulating tape and contacts wire braid at each end of repair.

(e) When approximately two-thirds of wrap is complete, let the short end of the loop show.

(f) Continue to wrap the wire to complete the remaining distance (shown as "1/3 X" in the figure).

(g) The maximum repair length "X" is 4 inches (101.600 mm).

(h) After the final wrap, insert the wire [1] through the loop.

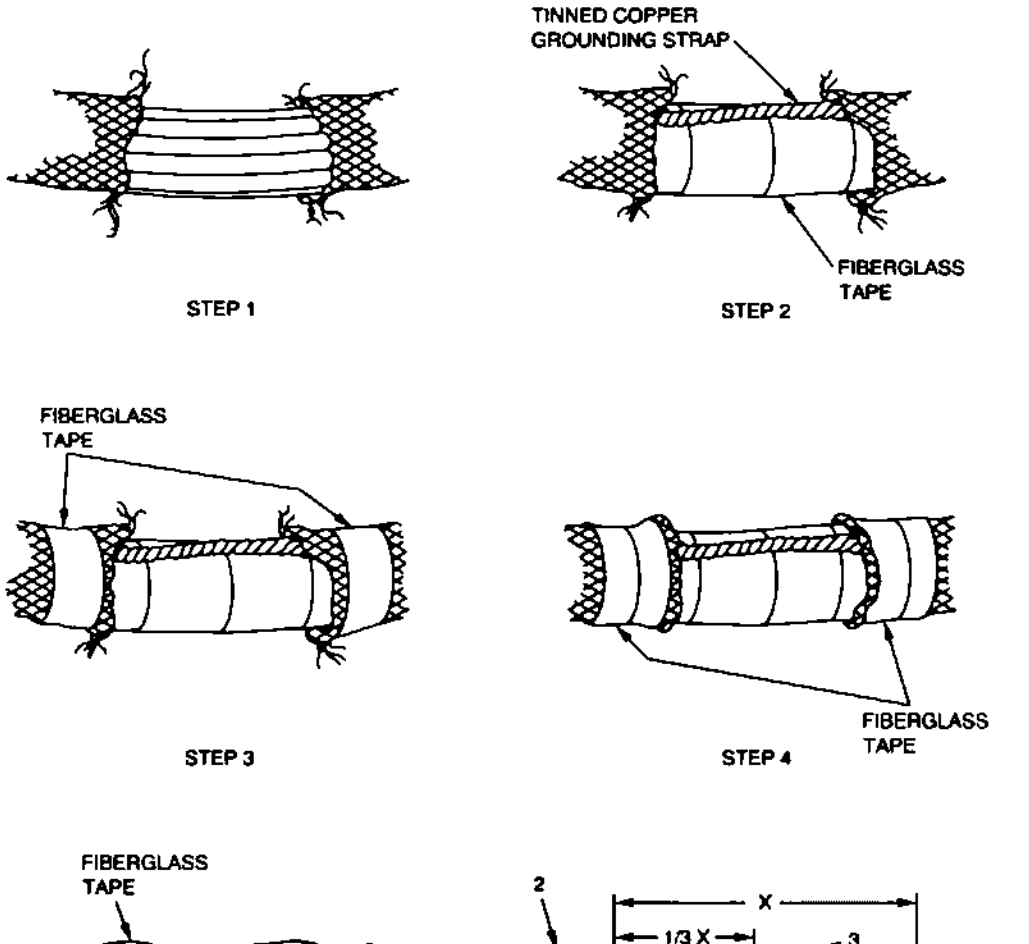
(i) Cut off the excess end of wire [2] so that the remaining length is approximately one third of the repair length.

(j) Pull the loop end [3] snug for a tight end loop then cut the wire end flush.

(7) Make sure that you fold the wire end so that you cannot get an injury.

G. Test the engine

(1) Test the engine. Refer to the specific AMM Test Reference Table, Test Requirements After Engine/Module/Component Repairs Or Replacement.



Cable Stainless Steel
Wire Braid Repair
Figure 801
(Task 70-71-00-300-001)

72-00-00

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72−50−00	TURBINE AND EXHAUST SECTION − DESCRIPTION−00 • 72−50−00−990−003: Turbine and Exhaust Section Description
72−50−00	TURBINE AND EXHAUST SECTION − MAINTENANCE PRACTICES−00 • 72−50−00−990−001: First Stage Turbine Vanes Removal/Installation See Section 72−40−00, COMBUSTION SECTION − REMOVAL/INSTALLATION. • First Stage Turbine Vanes Inspection • 72−50−00−210−002: First Stage Turbine Blades Inspection • 72−50−00−300−001: First Stage Turbine Blades Repair • 72−50−00−210−003: Second Stage Turbine Blades and Vanes Inspection • 72−50−00−210−004: Third and 4th Stage Turbine Blade Inspection

	• 72−50−00−420−001: Removal/Installation of No. 6 Bearing Oil Scavenge Pump • 72−50−00−440−001: Disassembly/Assembly of No. 6 Bearing Oil Scavenge Pump • 72−50−00−990−002: Special Tools
72−51−00	TURBINE NOZZLE SECTION − DESCRIPTION−00 • 72−51−00−990−001: Turbine Section
72−51−21	COMBUSTION CHAMBER REAR SUPPORT − MAINTENANCE PRACTICES−00 • 72−51−21−210−001: Inner And Outer Outlet Duct Continue In Service Limits (Make An Inspection With A Borescope Or Equivalent) • 72−51−21−210−002: Combustion Chamber Outer Outlet Duct
72−52−00	REAR COMPRESSOR DRIVE TURBINE ROTOR − DESCRIPTION−00 • 72−52−00−990−001: Rear Compressor Drive Turbine Rotor
72−53−00	FRONT COMPRESSOR DRIVE TURBINE ROTOR − DESCRIPTION−00 • 72−53−00−990−001: Front Compressor Drive Turbine Rotor • 72−53−00−990−002: Front Compressor Drive Turbine Rotor and Stator Assembly (Unit Turbine)
72−54−00	TURBINE EXHAUST CASE ASSEMBLY − DESCRIPTION−00 • 72−54−00−990−003: Turbine Exhaust Case • 72−54−00−990−004: Turbine Exhaust Strut Assembly
72−54−00	TURBINE EXHAUST CASE ASSEMBLY − MAINTENANCE PRACTICES−00 • 72−54−00−220−001: Turbine Exhaust Fairing Retaining Pin Wear • 72−54−00−220−002: Turbine Exhaust Fairing Bushing Wear • 72−54−00−220−003: Pin to Bushing Clearance • 72−54−00−210−001: Turbine Exhaust Duct and Fairing Struts Crack Limits And Repair (Sheet Metal Only) • 72−54−00−210−002: Turbine Exhaust Duct And Fairing Mount Boss Crack Limits • 72−54−00−220−004: Turbine Exhaust Strut Rod Wear And Blend Limits • 72−54−00−210−003: Turbine Exhaust Tangential Strut Rod Looseness Check (Mounted Engine) • 72−54−00−990−002: Numerical Tool List
72−55−00	FAN AND TURBINE EXHAUST (MIXER) SECTION − MAINTENANCE PRACTICES−00 • 72−55−00−420−001: Mixer Replacement (Engines With Mixer) • 72−55−00−300−001: Fan Exhaust Rear Duct Segment (Typical PN 774879, 5001080−01, 5001081−01, 810510−01, 810511−01)
72−60−00	ACCESSORY AND COMPONENT DRIVES GEARBOX HOUSING SECTION − DESCRIPTION−00 • 72−60−00−990−003: Accessory and Component Drives Gearbox Assembly

	• 72−60−00−990−004: Gearbox Protective Coating • 72−60−00−990−005: Accessory and Components Drives Gearbox Rear Housing • 72−60−00−990−006: Accessory and Component Drives Gearbox Front (Cover) Housing • 72−60−00−990−007: Power Lever Cross Shafts and Linkage
72−60−00	ACCESSORY AND COMPONENT DRIVES GEARBOX HOUSING SECTION − REMOVAL/INSTALLATION−00 • 72−60−00−990−001: General See Engine − Removal/Installation for general maintenance procedures • 72−60−00−420−001: Removal/Installation of Accessory Drives Gearbox • 72−60−00−423−001: Removal/Installation of Connecting Linkage − Cross Shaft−to− Fuel Control • 72−60−00−430−002: Installation and Adjustment of Connecting Linkage, Cross Shaft−to−Fuel Control • 72−60−00−430−003: Shutoff Lever Linkage Adjustment and Installation • 72−60−00−430−004: Holding or Turning Rear Compressor Rotor With the Starter Removed From the Gearbox • 72−60−00−990−002: Numerical Tool List
72−60−00	ACCESSORY AND COMPONENT DRIVES GEARBOX HOUSING SECTION − INSPECTION/CHECK−00 • 72−60−00−210−001: Accessory Drives Section
72−60−00	ACCESSORY AND COMPONENT DRIVES GEARBOX HOUSING SECTION − INSPECTION/CHECK−02 • 72−60−00−990−008: Accessory Drive Fits And Clearances
72−61−00	ACCESSORY AND COMPONENT DRIVES GEARBOX ASSEMBLY − REMOVAL/INSTALLATION−00 • 72−61−00−430−001: General • 72−61−00−430−002: Starter Drive Oil Seal Replacement • 72−61−00−430−003: Starter Drive Spline Adapter Removal/Installation • 72−61−00−430−004: Hydraulic Pump Drive Oil Seal Replacement • 72−61−00−430−005: CSD Oil Seal Replacement • 72−61−00−430−006: Constant Speed Drive/Alternator Drive Coupling Replacement • 72−61−00−430−007: Fuel Pump Drive Oil Seal Replacement • 72−61−00−430−008: Deoiler Seal Replacement − Gearboxes Incorporating Deoiler Carbon Seal Access Port (Post SB 4539) • 72−61−00−430−009: Removal/Installation Of Main Oil Pump • 72−61−00−430−010: Removal/Installation Of Main Oil Filter/Strainer • 72−61−00−430−011: Removal/Installation of the Oil Pressure Relief Valve • 72−61−00−430−012: N2 Tachometer Drive Gearshaft Seal Replacement • 72−61−00−430−013: Fuel Pump Rear Coupling Replacement • 72−61−00−990−001: Numerical Tool List

72-61-00	ACCESSORY AND COMPONENT DRIVES GEARBOX ASSEMBLY - INSPECTION/CHECK-00 • 72-61-00-990-002: Accessory And Component Drives Gearbox Assembly
72-61-10	STARTER DRIVE GEARSHAFT - INSPECTION/CHECK-00 • 72-61-10-990-001: Starter Drive Gearshaft
72-61-20	ACCESSORY AND COMPONENT DRIVES SPUR GEARSHAFT - INSPECTION/CHECK-00 • 72-61-20-990-001: Accessory And Component Drives Spur Gearshaft
72-61-40	TACHOMETER DRIVE (N2) GEARSHAFT - INSPECTION/CHECK-00 • 72-61-40-990-001: Tachometer Drive (N2) Gearshaft
72-61-50	MAIN OIL PUMP ASSEMBLY - INSPECTION/CHECK-00 • 72-61-50-990-001: Main Oil Pump Assembly
72-61-51	OIL PRESSURE RELIEF VALVE - MAINTENANCE PRACTICES-00 • 72-61-51-300-001: Oil Pressure Relief Valve Repair
72-61-51	OIL PRESSURE RELIEF VALVE - INSPECTION/CHECK-00 • 72-61-51-990-001: Oil Pressure Relief Valve
72-61-53	MAIN OIL STRAINER - MAINTENANCE PRACTICES-00 • 72-61-53-430-001: Disassembly/Assembly of the Main Oil Filter/Strainer • 72-61-53-990-001: Numerical Tool List
72-61-53	MAIN OIL STRAINER - INSPECTION/CHECK-00 • 72-61-53-990-002: Main Oil Strainer
72-61-53	MAIN OIL STRAINER - CLEANING/PAINTING-00 • 72-61-53-110-001: Cleaning the Main Oil Strainer
72-61-58	POWER LEVER CROSS SHAFTS - REMOVAL/INSTALLATION-00 • 72-61-58-430-001: Removal/Installation of Power Lever Cross Shafts
72-61-58	POWER LEVER CROSS SHAFTS - INSPECTION/CHECK-00 • 72-61-58-990-001: Power Lever Cross Shafts
72-61-63	FUEL CONTROL AND FUEL PUMP PAD BRACKET - REPAIR-00 • 72-61-63-300-001: Quick-Disconnect Nut

72−70−00	FAN DISCHARGE SECTION − DESCRIPTION−00 • 72−70−00−990−003: Fan Discharge Section • 72−70−00−990−004: Fan Discharge Case Assembly (and Fan Discharge Vanes)
72−70−00	FAN DISCHARGE SECTION − MAINTENANCE PRACTICES−00 • 72−70−00−990−001: General • 72−70−00−430−001: Removal/Installation of Rear Compressor Low Pressure Air Transfer Tubes (Left and/or Right Side) • 72−70−00−430−002: Removal/Installation of Rear Compressor Air Bleed Manifolds (Left and/or Right Side Eighth Stage Air) • 72−70−00−430−003: Removal/Installation of Diffuser Section Air Bleed Manifolds (Left and/or Right Side) • 72−70−00−430−004: Removal/Installation of Combustion Section Fan Duct • 72−70−00−430−005: Removal/Installation of Combustion Chamber Drain Manifold and Fuel Drain Valves (Front and/or Rear) • 72−70−00−430−006: Removal/Installation of the Rear Compressor Fairing Segments • 72−70−00−430−007: Removal/Installation of Left Spark Igniter Cable Fairing • 72−70−00−990−002: Numerical Tool List
72−71−00	FAN DISCHARGE DUCTS AND CASES − DESCRIPTION−00 • 72−71−00−990−001: Fan Discharge Outer Ducts And Fairings
72−71−01	FAN DISCHARGE FRONT COMPRESSOR OUTER DUCT − REPAIR−00 • 72−71−01−300−001: Front Compressor Outer Duct Crack And Indentation Repair (Deleted)
72−71−02	REAR COMPRESSOR DUCT CRACK AND INDENTATION REPAIR − REPAIR−00 • 72−71−02−300−001: Rear Compressor Outer Duct Crack And Indentation Repair (Deleted)
72−71−03	COMBUSTION CHAMBER AND TURBINE FAN DUCT − REPAIR−00 • 72−71−03−300−001: Duct Crack And Indentation Repair
72−71−10	FAN DISCHARGE AIR BLEED MANIFOLDS AND SLEEVES − DESCRIPTION−00 • 72−71−10−990−001: Fan Discharge Air Bleed Manifolds And Sleeves
72−71−20	FAN DISCHARGE FAIRINGS − DESCRIPTION−00 • 72−71−20−990−001: Fan Discharge Fairings

Task 72-00-00-990-002:

1. Description

A. General

(1) These instructions are based on the assumption that the reader is already familiar with the fundamentals and theory of a turbojet engine. In the following description of the JT8D engine, frequent reference may be made to fundamental and theoretical principles as an aid to discussing the configurational relationships of the parts and assemblies of this engine. If the reader is not yet familiar with turbojet fundamentals and theory, it is recommended that reference be made to the following P&W publication, copies of which have been supplied to all commercial operators of P&W engines:

"General Operating Instructions for Dual Axial Compressor Non-Afterburning Turbojet Engines"

(2) This engine operates similarly to all turbojet versions of a gas turbine engine in that it derives its propulsive force through the application of Sir Isaac Newton's third law which states that for every action there is an equal and opposite reaction. The engine cases form the backbone of the engine when bolted together, and support all of the inner parts of the engine through struts and bearings. The fan discharge air is ducted outside the inner cases because the air has already been accelerated by the fan and has therefore served its purpose of providing additional thrust, the same kind of additional thrust that would be gained from air passing through the propeller of a turboprop or reciprocating engine.

(3) The JT8D engine is an axial flow front turbofan engine having a thirteen stage split compressor, a nine can (can-annular) combustion chamber, and a split four stage reaction impulse turbine. See Figure 1. The engine is equipped with a full length annular fan discharge duct. The low pressure system is made up of the front compressor rotor and the second and third and fourth stage turbine rotors and is mechanically independent of the high pressure system which consists of the rear compressor rotor and the first stage turbine rotor. The engine is mounted from two points. The front mount is located at the fan discharge intermediate case. The engine rear is located at the turbine exhaust section outer duct.

(4) Model Differences

(a) The JT8D-1, -1A, -1B, -7, -7A, -7B, -9, -9A, -11, -15, -15A, -17, -17A, -17R and -17AR engines are basically the same except for minor physical differences dependent upon the incorporation of changes. Main features of various models are listed in Table 1.

Task 72-00-00-990-003:

2. ENGINE SPECIFICATIONS

A. General

Type	Axial-Flow, gas turbine turbo fan
Number of Combustion Chambers	9
Type of Combustion Chamber	Can-annular
Type of Compressor	Two-spool, 13 stage, front fan, having a 6 stage low pressure compressor and a 7 stage high pressure compressor
Type of Turbine	4 stage, split, having 1st stage high pressure and second, third, and 4th stage low pressure

Engine Dry Weight (approx.)

JT8D-1,-1A,-1B	3155 lbs
JT8D-7,-7A,-7B	3205 lbs
JT8D-9	3252 lbs
JT8D-9A	3377 lbs
JT8D-11	3389 lbs
JT8D-15	3414 lbs
JT8D-15A	3474 lbs
JT8D-17	3430 lbs
JT8D-17A	3475 lbs
JT8D-17R	3495 lbs
JT8D-17AR	3500 lbs

Engine Length at Room Temperature (approx.)	123.5 inch
Engine Inlet Diameter at Room Temperature (approx.)	42.5 inch
Ignition System	
Ignition Exciter	Unison (Bendix-Scintilla) or Simmonds (General Laboratory Associates) (GLA)
Igniter Plugs	Champion
Lubricating System	
Oil Specification	PWA 521
Oil Tank	
Usable quantity	4.0 gallons
Fuel System	
Fuel Specification	See SB 2016
Fuel Control	Hamilton Standard
Fuel Pump	ArgoTech (Thompson Ramo Woolridge)

Model	Take-Off Thrust (lbs.)	Turbine	Compressor Case	Fuel System	Oil Damped Bearings
JT8D-1 -1A,-1B **	*14,000 at or below 59°F (15°C)	Unit. Non-unit for engines prior to SB 1194	Bolted on No. 2 and 3 Bearing Housings. Integral Housings prior to SB 2590	Chevron Seal	Bearing No. 1 and 6 Positions. Non-damped for engines prior to SB 2141 and 2240
JT8D-7, -7A,-7B ***	*14,000 at or below 84°F (28.9°C)	Unit	Bolted on No. 2 and 3 Bearing Housings. Integral Housings prior to SB 2590	Chevron Seal	Bearing No. 1 and 6 Positions. Non-damped for engines prior to SB 2141 and 2240

Engine Model Differences
Table 1

Model	Take-Off Thrust (lbs.)	Turbine	Compressor Case	Fuel System	Oil Damped Bearings
JT8D-9, -9A****	*14,500 at or below 84°F (28.9°C)	Unit	Bolted on No. 2 and 3 Bearing Housings. Integral Housings prior to SB 2590	Conical Seat (Chevron Seal for engines prior to SB 2722)	Bearing No. 1 and 6 Positions.
JT8D-11	*15,000 at or below 84°F (28.9°C)	Unit. Air Cooled 1st Stage	Bolted on No. 2 and 3 Bearing Housings.	Conical Seat	Bearing No. 1 and 6 Positions.
JT8D-15	*15,500 at or below 84°F (28.9°C)	Unit Tangential Air Cooled 1st Stage	Bolted on No. 2 and 3 Bearing Housings.	Conical Seat	Bearing No. 1, 5, and 6 Positions.
JT8D-15 ##	A *15,500 at or below 84°F (28.9°C)	Improved Unit	Bolted on No. 2 and 3 Bearing Housings.	Conical Seat	Bearing No. 1, 5, and 6 Positions.
JT8D-17	*16,000 at or below 84°F (28.9°C)	Unit Increased Cooling 1st Vanes and Blades Coated 2nd Stage Blade	Bolted on No. 2 and 3 Bearing Housings.	Conical Seat Increased flow rates.	Bearing No. 1, 5, and 6 Positions.
JT8D-17A ##	*16,000 at or below 84°F (28.9°C)	Improved Unit	Bolted on No. 2 and 3 Bearing Housings.	Conical Seat Increased flow rates.	Bearing No. 1, 5, and 6 Positions.

Engine Model Differences
Table 1 (Continued)

Model	Take-Off Thrust (lbs.)	Turbine	Compressor Case	Fuel System	Oil Damped Bearings
JT8D -17R#	*16,400 at or below 77°F (25°C), 17,400 at or below 77°F (25°C) under thrust reset conditions	Unit Revised Material 2nd Stage Vanes Shielded Turbine Nozzle Case	Bolted on No. 2 and 3 Bearing Housings	Conical Seat	No. 1, 5, and 6 Bearing Positions
JT8D -17AR# ##	*16,400 at or below 77°F (25°C), 17,400 at or below 77°F (25°C) under thrust reset conditions	Improved Unit	Bolted on No. 2 and 3 Bearing Housings	Conical Seat	No. 1, 5, and 6 Bearing Positions

*Per data provided in detailed specifications.

**The JT8D-1A engine differs from the JT8D-1 as follows:
Reduced-smoke combustion chambers.
Forged 1st stage turbine blades.
Air-cooled 1st stage turbine stator vanes.
The JT8D-1B engine differs from the JT8D-1A as follows:
PWA 655 4th stage turbine stator vanes and thicker 4th stage turbine stator shroud.

***The JT8D-7A engine differs from the JT8D-7 as follows:
One piece turbine front case with reduced number of air-cooled 1st stage vanes.
Plasma-coated 2nd, 3rd, and 4th stage turbine vanes and inner shrouds.

The JT8D-7B engine differs from the JT8D-7A as follows:
PWA 655 4th stage turbine stator vanes and thicker 4th stage turbine stator shroud.

Model	Take-Off Thrust (lbs.)	Turbine	Compressor Case	Fuel System	Oil Damped Bearings

****The JT8D-9A engine differs from the JT8D-9 as follows:
Reduced smoke combustion chambers.
Elliptical slotted 3rd stage turbine disk and blade assembly.
Plasma-coated 2nd, 3rd, and 4th stage turbine vanes and inner shrouds.

#The JT8D-17R engine differs from the JT8D-17 as follows:
Thicker fan cases.
Revised front compressor blades.
Revised 10th stage compressor disks and spacers.
Turbine nozzle case shield.
Fuel control with thrust reset mechanism.

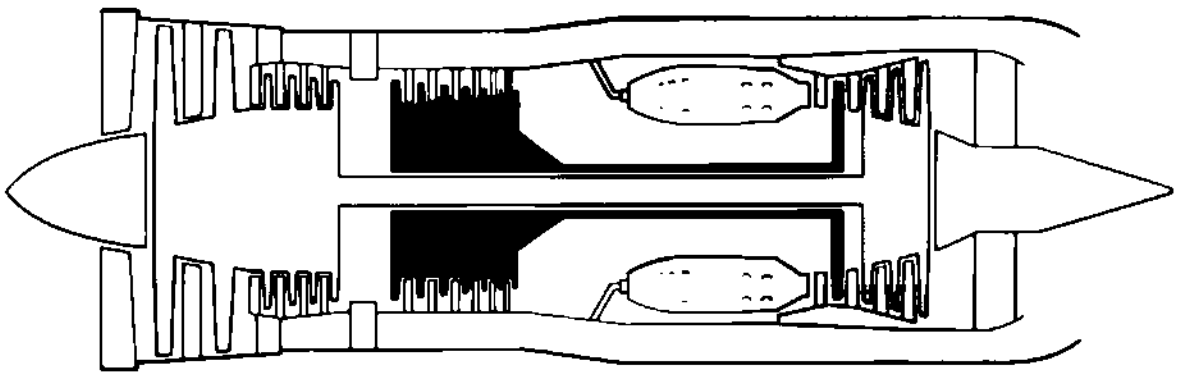
##The JT8D-15A,-17A, and -17AR engines differ from the JT8D-15, -17, and -17R as follows:
Revised inlet case (see Note).
Revised 1st and 2nd stage fan blades.
Revised 1st and 2nd stage compressor stators (see Note).
Front and rear fan cases with nickel-graphite coating in blade tip rub area (see Note).
Rear compressor front hub with metering plugs in air holes.
SermeTel coated rear compressor stators.
Carbon-type No. 4 Bearing seal.
First stage turbine vanes with platform seals (see Note).
Aerodynamically redesigned 1st through 4th stage turbine.

NOTE: Inlet case, 1st and 2nd stage compressor stators, fan cases, SermeTel-coated stators, carbon-type No. 4 bearing seal, and platform-seal turbine vanes are available to other JT8D models as performance improvement modifications.

Engine Model Differences
Table 1 (Continued)

Task 72-00-00-990-004:

3. DIRECTIONAL REFERENCES



L-10696

Split Compressor And Turbine
Figure 1
(Task 72-00-00-990-002)

A.

Unless otherwise specified in the procedural text, right and left, clockwise and counterclockwise, upper and lower, and similar directional references apply to the engine as viewed from the rear (exhaust end) with the engine in a horizontal position and with the main accessory section at the bottom of the engine. The rotation of the rotor assemblies is clockwise.

Task 72-00-00-990-005:

4. COMBUSTION CHAMBER NUMBERING

A. The combustion chambers are numbered one to nine in a clockwise direction, with the top center combustion chamber designed as number one. The number four and seven chambers have spark igniter bosses.
See Figure 2.

Task 72-00-00-990-006:

5. MAIN BEARING NUMBERING AND COMPANION SEAL IDENTIFICATION

A. In practice the main engine bearings are commonly referred to, as to location, by number. In the interests of brevity and clarity these bearings and their companion seals will be referred to by number in this publication. The following bearing designation table is provided to familiarize personnel with the full nomenclature, location, and designated number of the bearings. The companion seal types are described in Main Shaft Oil and Airseal.
See Figure 3.

NAME	LOCATION	NUMBER	TYPE
Front Compressor Front	Inlet case; Front compressor front hub	1	Roller
Front Compressor Rear	Compressor (intermediate) case front; Front compressor rotor rear hub	2	Duplex Ball
Rear Compressor Front	Compressor (intermediate) case rear; Main accessory drive gear	3	Ball
Rear Compressor	Diffuser case; Rear compressor rotor rear	4	Duplex Ball

Bearing Designation
Table 1

NAME	LOCATION	NUMBER	TYPE
(CONTINUED)			
Rear	hub		
Turbine Inter-shaft	In line with mid-point of combustion chamber case; Outer race within rear compressor drive turbine shaft; Inner race and rollers on front compressor drive turbine shaft	4 1/2	Roller
Turbine Front	In line with combustion chamber case rear flange; Inner race on rear compressor drive turbine shaft	5	Roller
Turbine Rear	Turbine exhaust case; Front compressor drive turbine rear hub	6	Roller

Bearing Designation
Table 1 (Continued)

Task 72-00-00-990-007:

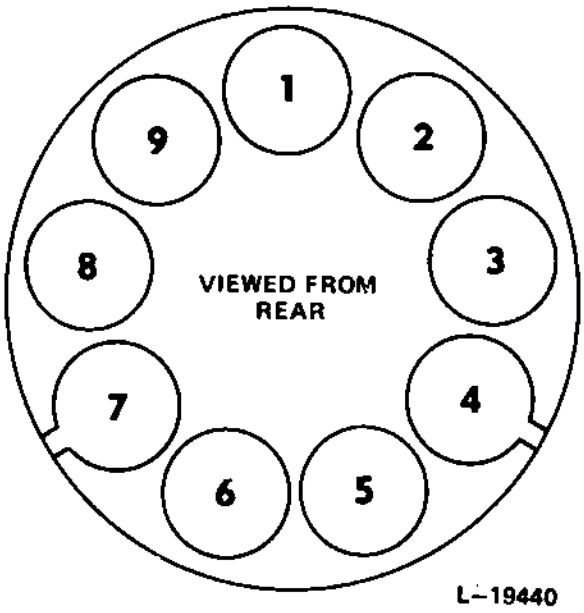
6. ENGINE SECTIONS

A. The engine has six general sections, the air inlet section, the compressor section, the combustion section, the turbine and exhaust section, the accessory drives, and the fan discharge section. Detailed information on each is given within the appropriate code-numbered sections of the manual. See Figure 4.

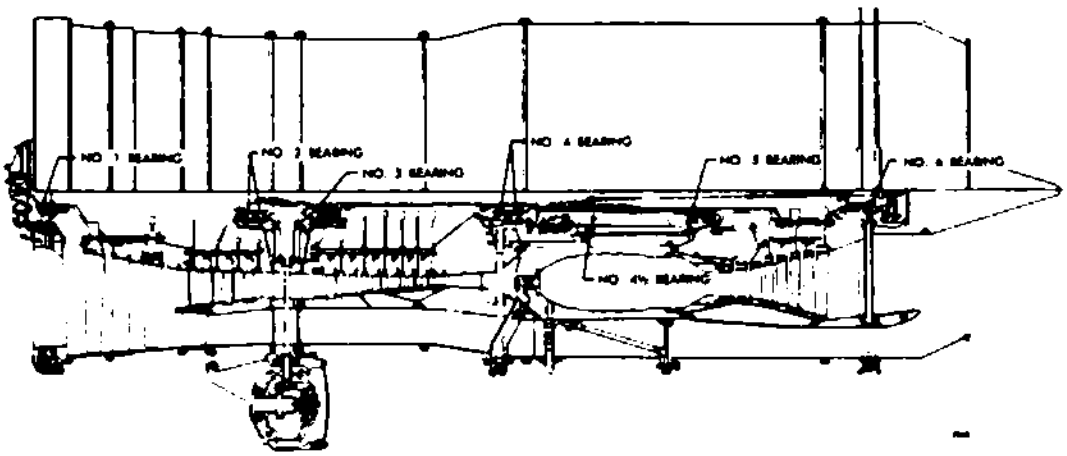
Task 72-00-00-990-008:

7. ENGINE FLANGE DESIGNATIONS

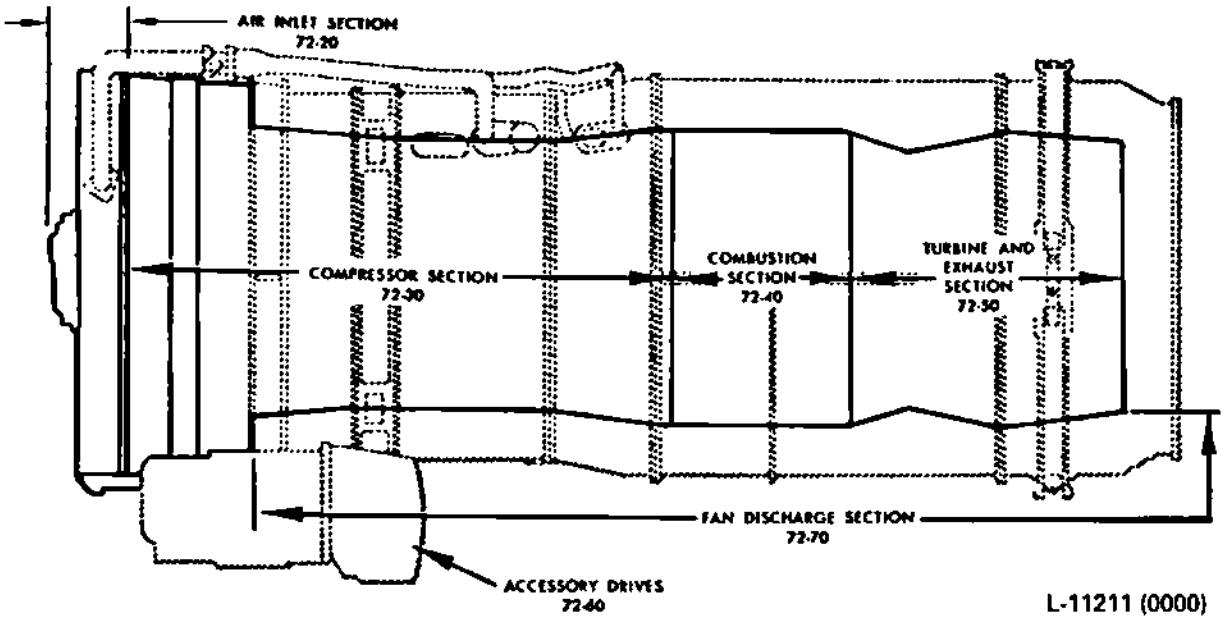
A. To facilitate identification of the engine flanges, they are designated by letter. Interruptions in the lettering sequence may result where development changes have removed or added flanges.
See Figure 5.



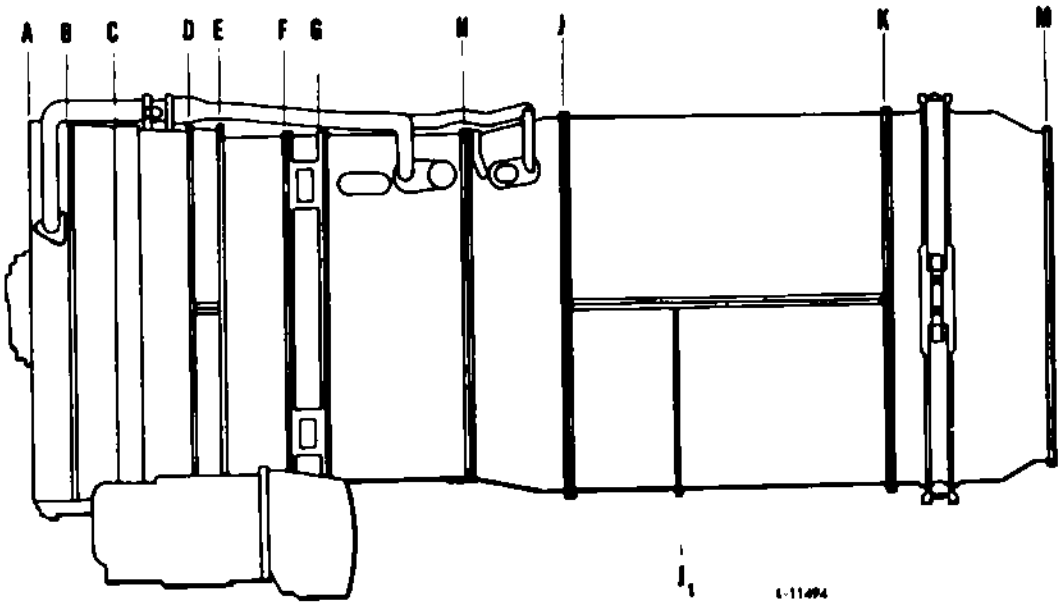
Combustion Chamber Numbering
Figure 2
(Task 72-00-00-990-005)



Bearing Location Reference
Figure 3
(Task 72-00-00-990-006)



Identification Of Engine Sections
Figure 4
(Task 72-00-00-990-007)



Engine Flange Designations
Figure 5
(Task 72-00-00-990-008)

Task 72-00-00-990-009:

8. ENGINE SECTIONAL NUMBERING

A. ENGINE SECTIONAL NUMBERING

AIR INLET SECTION	72-20
COMPRESSOR SECTION	72-30
COMBUSTION SECTION	72-40
TURBINE AND EXHAUST SECTION	72-50
ACCESSORY DRIVES	72-60
FAN DISCHARGE SECTION	72-70

Task 72-00-00-990-010:

9. FAN DISCHARGE SECTION

A. Fan Discharge Section

(1) Bolted behind the front compressor case is the fan discharge case assembly. Enclosed within it are the fan discharge vanes.

(2) At this location the gas flow divides, with the fan discharge air passing through these vanes and the central air stream passing through the basic inner engine.

(3) Enclosing the engine, from the fan discharge case rearward, is a series of fan discharge outer ducts and cases. These outer ducts and the outer surface of the inner ducts, and basic engine cases, form the annular duct air passage for fan discharge air to flow to the rear of the engine. The fan discharge section is described in greater detail in Section 72-70-00, Fan Discharge Section.

Task 72-00-00-990-011:

10. ACCESSORY AND COMPONENTS DRIVES

A. ACCESSORY AND COMPONENTS DRIVES

(1) There are two units on the engine to accommodate accessory and components drives. The first is the front accessory drive housing which is mounted on the front of the inlet case. It incorporates, on its front face, an external pad for mounting an N1 (front compressor) tachometer generator. See Section 72-20, Air Inlet Section, for detailed information.

(2) The second unit is the accessory and components drive gearbox, mounted beneath the engine at the fan discharge intermediate case. It has one drive pad for the fuel pump and fuel control. In addition, one 10-inch and two 5-inch drive pads are incorporated for airframe-furnished accessories such as an alternator, starter, and hydraulic pump. A standard pad is provided for an N2 tachometer generator. Oil pressure and oil scavenge pumps (in one pump assembly), an oil pressure relief valve, and an oil strainer and bypass valve are incorporated. See Section 72-60-00, Accessory Drives, for a detailed description.

Task 72-00-00-990-012:

11. MAIN SHAFT BEARINGS

A. General

(1) The front compressor system (low pressure) with its related turbine rotor, is supported by four anti-friction bearings - one (No. 1) in front of and one (No. 2) behind the front compressor rotor and one (No. 4 1/2) in front of and one (No. 6) behind the front compressor drive turbine rotor. The No. 2 bearing assembly consists of a matched pair of ball thrust bearings and locates the front compressor system axially.

(2) The rear compressor system (high pressure) and related turbine rotor, is mounted on three anti-friction bearings - one (No. 3) in front of and one (No. 4) behind the rear compressor rotor and one (No. 5) in front of the rear compressor drive turbine rotor. The No. 4 bearing assembly consists of a matched pair of ball thrust bearings and locates the rear compressor system axially.

(3) The main accessory drive gearshaft rotates inside the upper roller and lower ball bearing inside the intermediate section of the compressor case. See Figure 3 for the location of all the main shaft bearings and Figures 6 through 12 for details of each bearing arrangement.

B. Structure

(1) All the roller bearings employ a one piece cage, a recessed race ring and a plain raceway ring. Either the inner or the outer ring of a bearing may be the recessed race ring, the determining factor being assembly and disassembly requirements. The rollers in the bearings are crowned in a conventional fashion.

(2) Engines equipped with an oil dampened No. 1 bearing configuration have a larger bearing outer race (ring), lugs on the front face for locking with a retaining plate, and grooves in the outer race OD to hold metal seal rings. The outer race is held by four bolts rather than bearing retaining nut.

(3) The main shaft thrust bearings (No. 2 and No. 4) are used in tandem pairs in order to obtain a better safety margin. The bearings are manufactured in matched pairs and assembled in the engine in a manner to obtain the best possible distribution of load for this type of arrangement. The bearing oil baffle, which is positioned between the bearing outer races, serves to ensure the proper distribution of oil to each of the two bearings, and also, in case of failure of one bearing, prevents a flow of chips into the second bearing. The inner races of each bearing are split to permit a maximum ball complement as well as a one piece cage.

Task 72-00-00-990-013:

12. MAIN SHAFT OIL AND AIRSEALS

A. General

(1) The main shaft seals for the Nos. 1, 2, 3, and 4 bearing locations are labyrinth type. Split ring type seals are used at the No. 4 1/2 and 6 bearing locations. A face type seal with two expanding metal seal rings is used at the No. 5 bearing location.

(2) The following table lists the main shaft seals by companion bearing number and type.

Number	Type	Location
1	Labyrinth Seal	Rear of No. 1 Bearing
2	Labyrinth Seal	Forward of No. 2 Bearing
3	Labyrinth Seal	Rear of No. 3 Bearing
4	Labyrinth Seal (Early) Face Type Seal (Current)	Forward of No. 4 Bearing
4 1/2	Split Ring Seal	Rear of No. 4 1/2 Bearing
5	Face Type Seal	Rear of No. 5 Bearing
6	Split Ring Seal	Forward of No. 6 Bearing

Oil and Airseals
Table 2

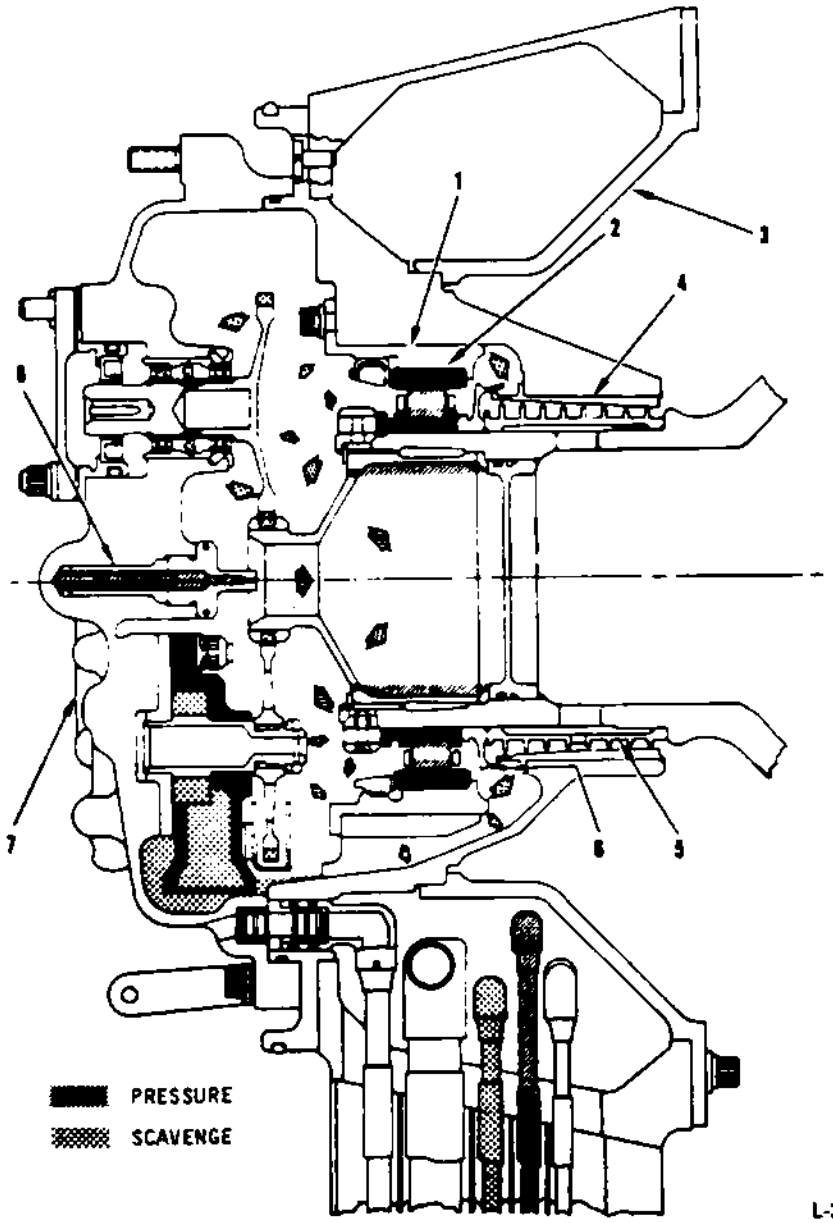
B. No. 1 Bearing Seal
See Figure 6.

(1) At the No. 1 bearing, a stainless steel seal with multiple knife-edges is mounted on the front hub of the front compressor rotor. This seal rotates inside an aluminum multi-platform seal ring positioned inside the No. 1 bearing front support. In front of the knife-edge seal, a steel oil slinger is positioned behind the No. 1 bearing inner race on the front hub.

C. No. 2 Bearing Oil and Airseals
See Figure 7.

(1) Mounted on the front compressor rotor rear hub (forward of the No. 2 bearings) from front to rear, are a multiple knife-edge airseal, a multiple knife-edge oil seal, and an oil baffle. The oil seal is cantilevered forward so that it is concentric, and outside of, the smaller airseal.

(2) Both the oil seal and airseal rotate inside stationary, stepped seal rings, riveted to the front of the No. 2 bearing seal ring support. At the bottom of the seal ring support, an air bleed boss accommodates the No. 2 bearing air bleed tube which vents into the No. 2 and 3 bearing seal air system.



No. 1 Bearing,
Seal, And Lubrication
(Non-Oil-Damped Bearing)
Figure 6 (Sheet 1)
(Task 72-00-00-990-012)

1. No. 1 Bearing Housing
2. No. 1 Bearing
3. Rear Support
4. Seal Ring
5. Bearing Seal
6. Oil Slinger
7. Front Accessory Drives Support
8. Oil Nozzle

Key to Figure 6 (Sheet 1)

(3) The oil baffle and oil seal oppose the action of the oil to come through the labyrinth. The air pressure behind the labyrinth air-seals further opposes the oil. Any oil which may seep by the seals will be carried off as oil vapor through the air bleed tube.

D. No. 2 and 3 Bearing Seal Air Tubes

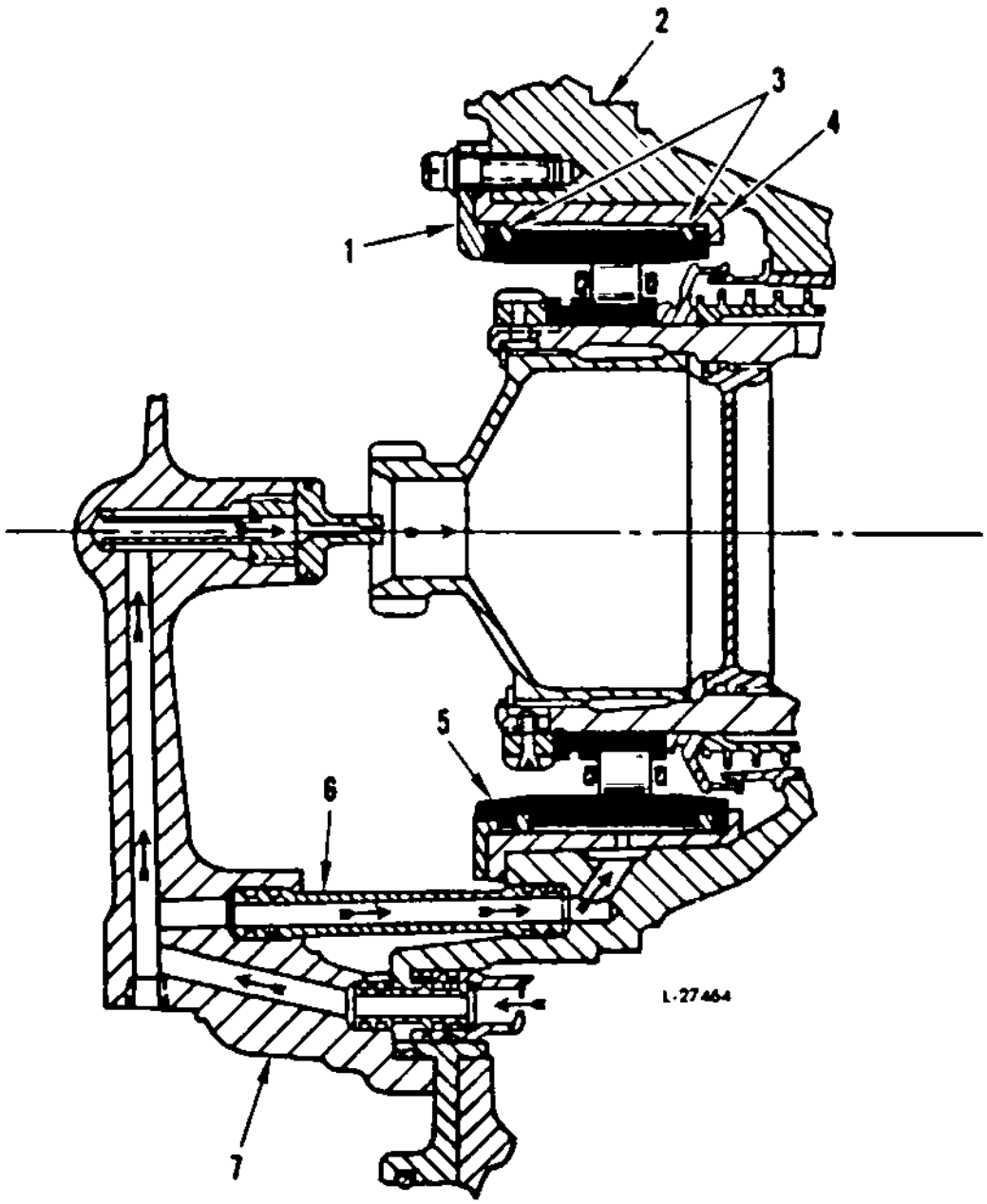
(1) Welded between the No. 2 and 3 bearing housings at the 9, 12, and 3 o'clock positions are three air tubes. See Figure 8. These three curved tubes run between the compressor intermediate inner case and the bearing housing; air pressure to the 12 o'clock position on the housing, air bleed from the 3 o'clock and the 9 o'clock position on the housing. A smaller air bleed tube runs to the 8 o'clock position of the inner case from a boss on the housing at the 7 o'clock position.

(2) Air enters the two o'clock position by two drilled holes in the inner wall of the vane support. The air passes inward through this tube then through the labyrinth seal compartments, cooling them. It passes outward through the other tubes, through the vanes at the five, eight and eleven o'clock positions and vents into the fan discharge air path.

(3) A No. 3 bearing oil/air tube for any oil which may bypass the seal runs from the bottom of the bearing housing down to the five o'clock vane and into the air bleed tube at that location.

E. No. 3 Bearing Seal
See Figure 7.

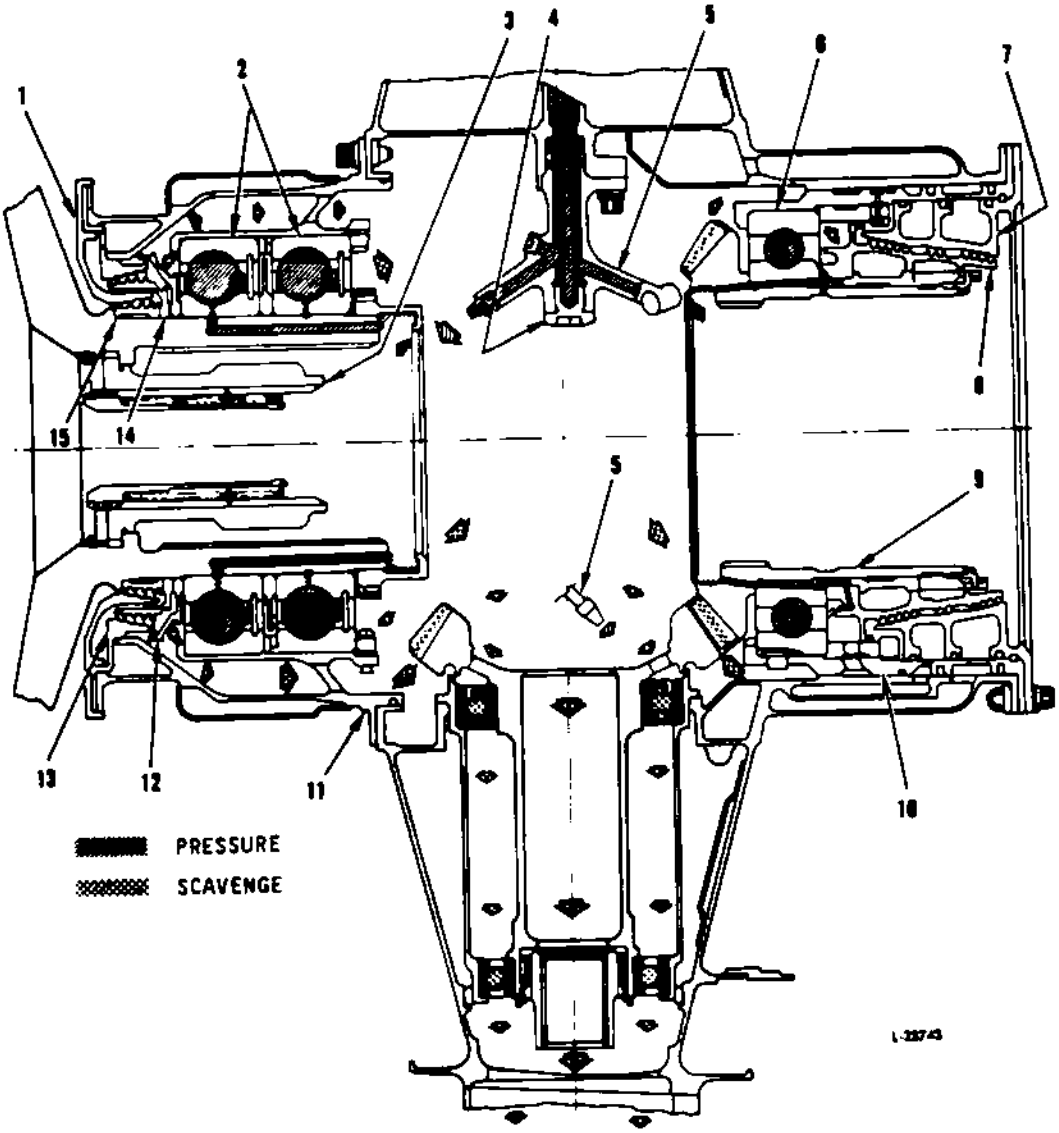
(1) To the rear of the No. 3 bearing, a steel multiple knife-edge oil and airseal is mounted on the gearbox drive bevel gear. This seal incorporates a steel spacer brazed inside and oil holes between the front groove and the front inner surface.



1. Retaining Plate
2. No. 1 Bearing Support
3. Seal Rings
4. No. 1 Bearing Housing
5. Oil Dampened No. 1 Bearing Outer Race
6. Transfer Tube
7. Front Accessory Support

No. 1 Bearing Lubrication

(Oil-Damped Bearing)
Figure 6 (Sheet 2)
(Task 72-00-00-990-012)



No. 2 And 3 Bearings,
Seals, And Lubrication
Figure 7
(Task 72-00-00-990-012)

1. No. 2 Bearing Inner Airseal Ring
2. No. 2 Bearing
3. Front Compressor Rotor Rear Hub Coupling
4. Oil Strainer Element Assembly
5. Oil Nozzle Assembly
6. No. 3 Bearing
7. No. 3 Bearing Airsealing Ring
8. No. 3 Bearing Seal Assembly
9. Gearbox Drive Bevel Gear
10. No. 3 Bearing Housing
11. No. 2 Bearing Housing
12. Oil Baffle
13. No. 2 Bearing Outer Airseal Ring
14. No. 2 Bearing Air/Oil Seal
15. No. 2 Bearing Airseal

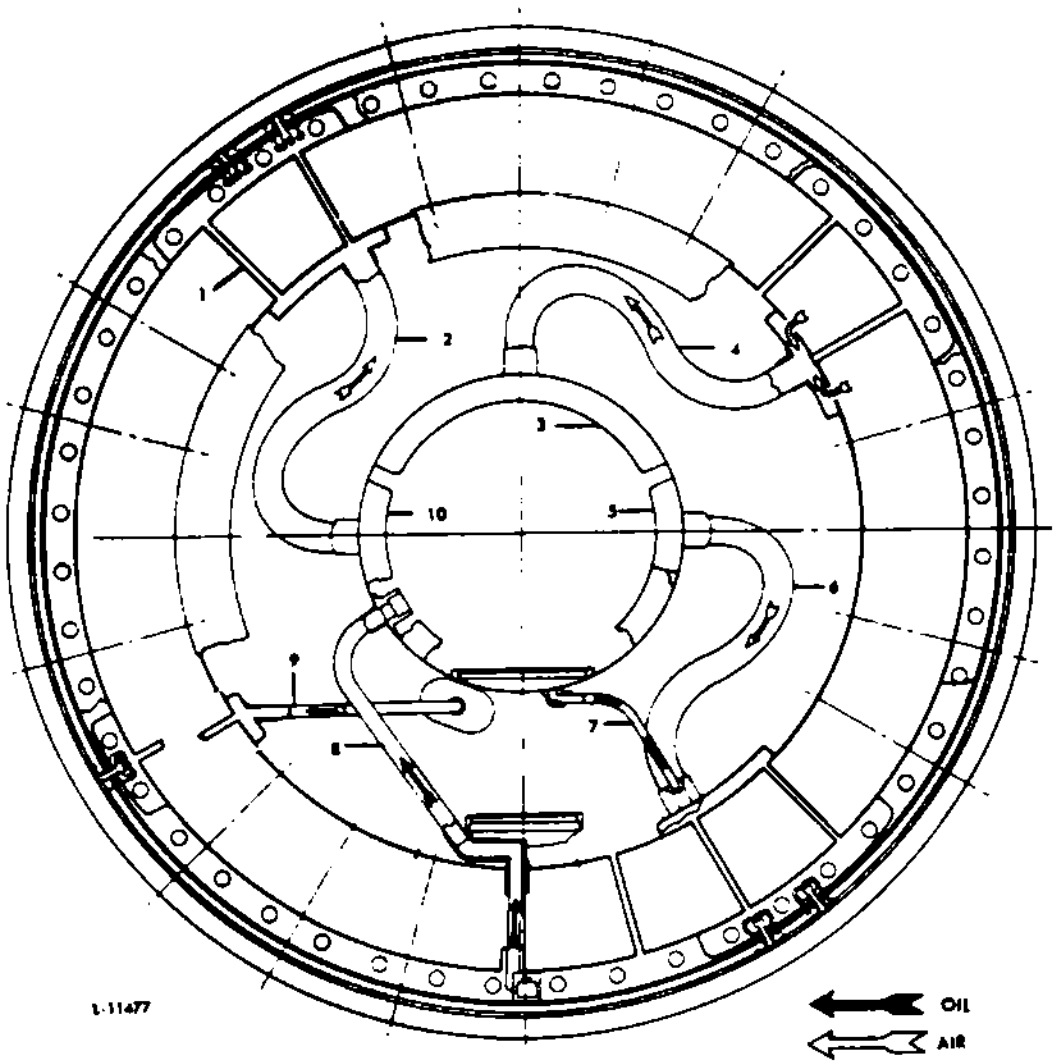
Key to Figure 7

(2) Bolted to the No. 3 bearing end of the intermediate case is the No. 3 bearing housing and airseal ring assembly. A packing and two seal rings on the OD of both the housing and seal ring assembly prevent leakage. On the ID, it incorporates sealing platforms in the ID and, at the inner (large ID) end, a platform type oil seal ring riveted in place. The knife-edge seal on the bevel gear rotates inside the platform-type ring assembly.

F. No. 4 Bearing Seal and Seal Air Tubes
See Figure 9.

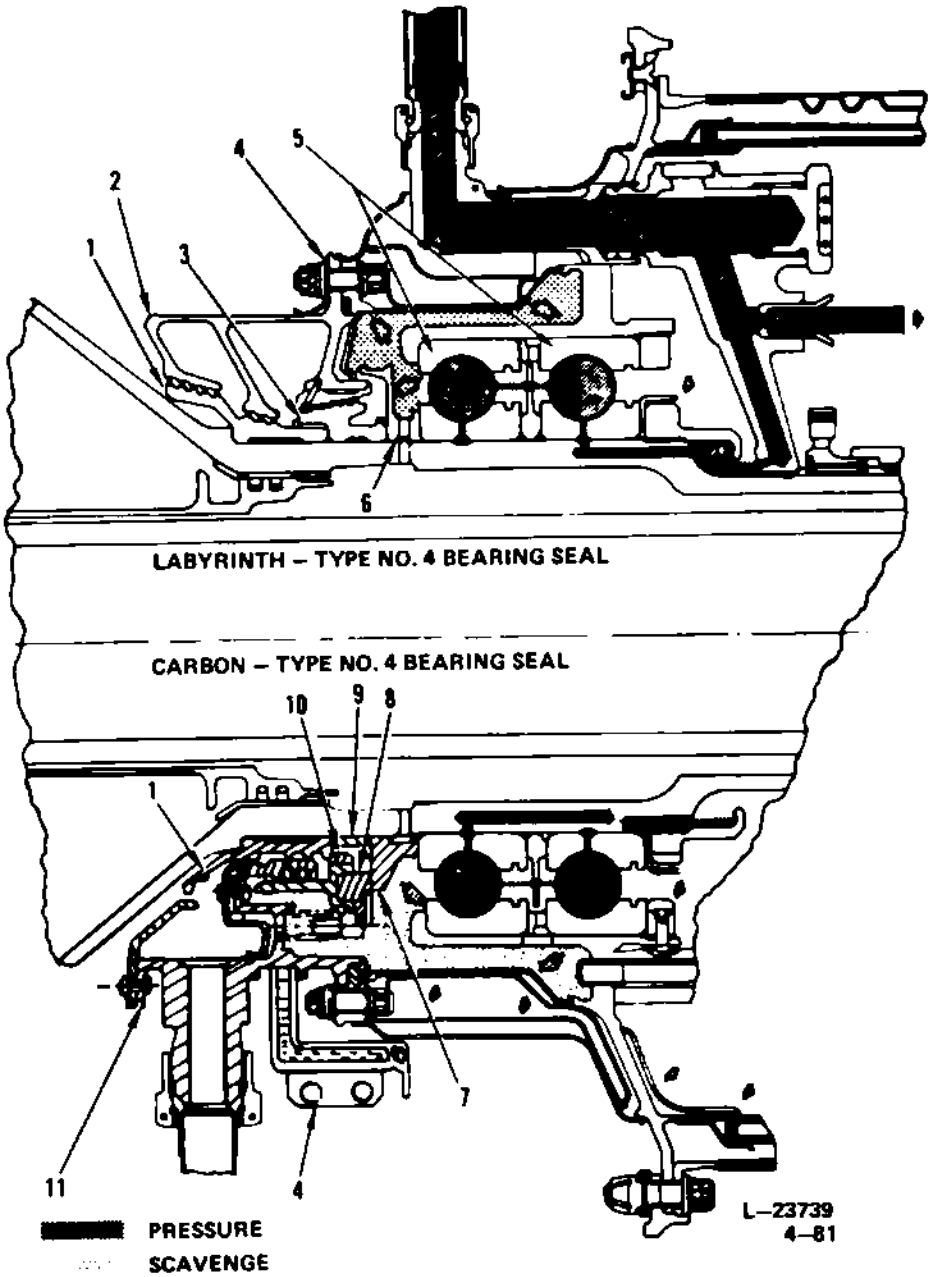
(1) Labyrinth-Type Seal:

(a) The No. 4 bearing airseal, mounted on the rear compressor rotor rear hub, is steel and has two groups of knife-edge seals on its OD. These knife-edges rotate inside multi-stepped platform rings which are an integral part of the No. 4 bearing oil seal ring assembly, bolted to the front of the No. 4 bearing support.



1. Sixth Stage Vane (24) Tube
2. Seal Air Tube Discharge Tube
3. Seal Manifold Segment (Reference)
4. Seal Air Tube Air Bleed
5. Seal Bleed Manifold Segment
6. Seal Air Tube
7. Mixed Oil/Air Discharge Tube
8. Oil Pressure Tube (Reference)
9. No. 2 Bearing Rear Air Bleed Tube
10. Seal Bleed Manifold Segment

No. 2 And 3 Bearing
Seal Air Tubes
Figure 8
(Task 72-00-00-990-012)



No. 4 Bearing, Seals,
And Lubrication
Figure 9
(Task 72-00-00-990-012)

1. Front Air Seal
2. Oil Seal Ring Assembly
3. Seal
4. Front Heatshield
5. No. 4 Bearing
6. Oil Baffle
7. Seal Seat
8. Main Carbon Face Seal
9. Spacer
10. Backup Carbon Face Seal
11. No. 4 Bearing Seal Assembly

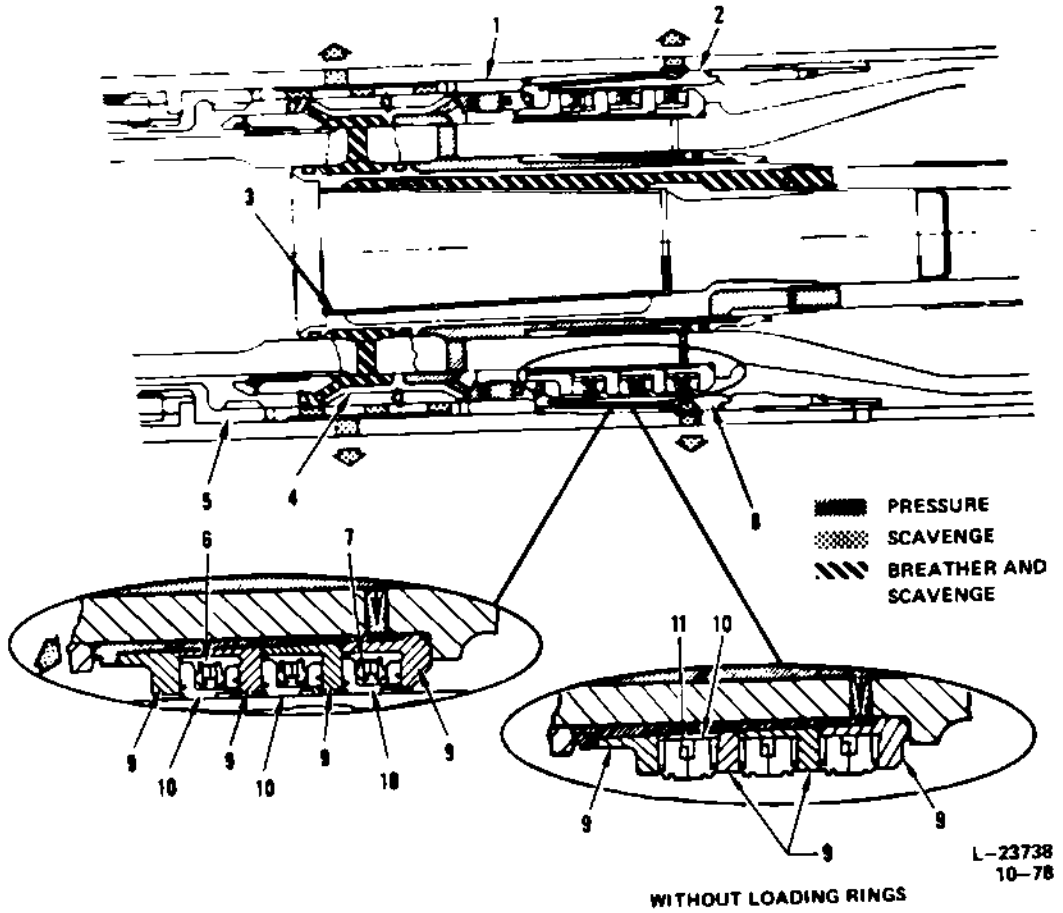
Key to Figure 9

(b) The oil seal ring assembly incorporates three seal tube openings to which are connected the No. 4 bearing air tubes. The tubes bring eighth stage discharge air to the annulus between the second and third labyrinth seal units and bleed air from the annulus between the first and second labyrinth units to the fan discharge path. The moving air holds down the bearing compartment temperature by bleeding hot air before it can reach the bearing compartment.

(c) Aft of the airseal, also mounted on the rear hub, is a steel knife-edge oil seal which rotates inside the multi-stepped oil seal ring pinned in place in the rear of the No. 4 bearing oil seal ring assembly. Mounted on the rear hub behind the airseal is a steel ring-type oil baffle which opposes the action of the oil to enter the seal labyrinth.

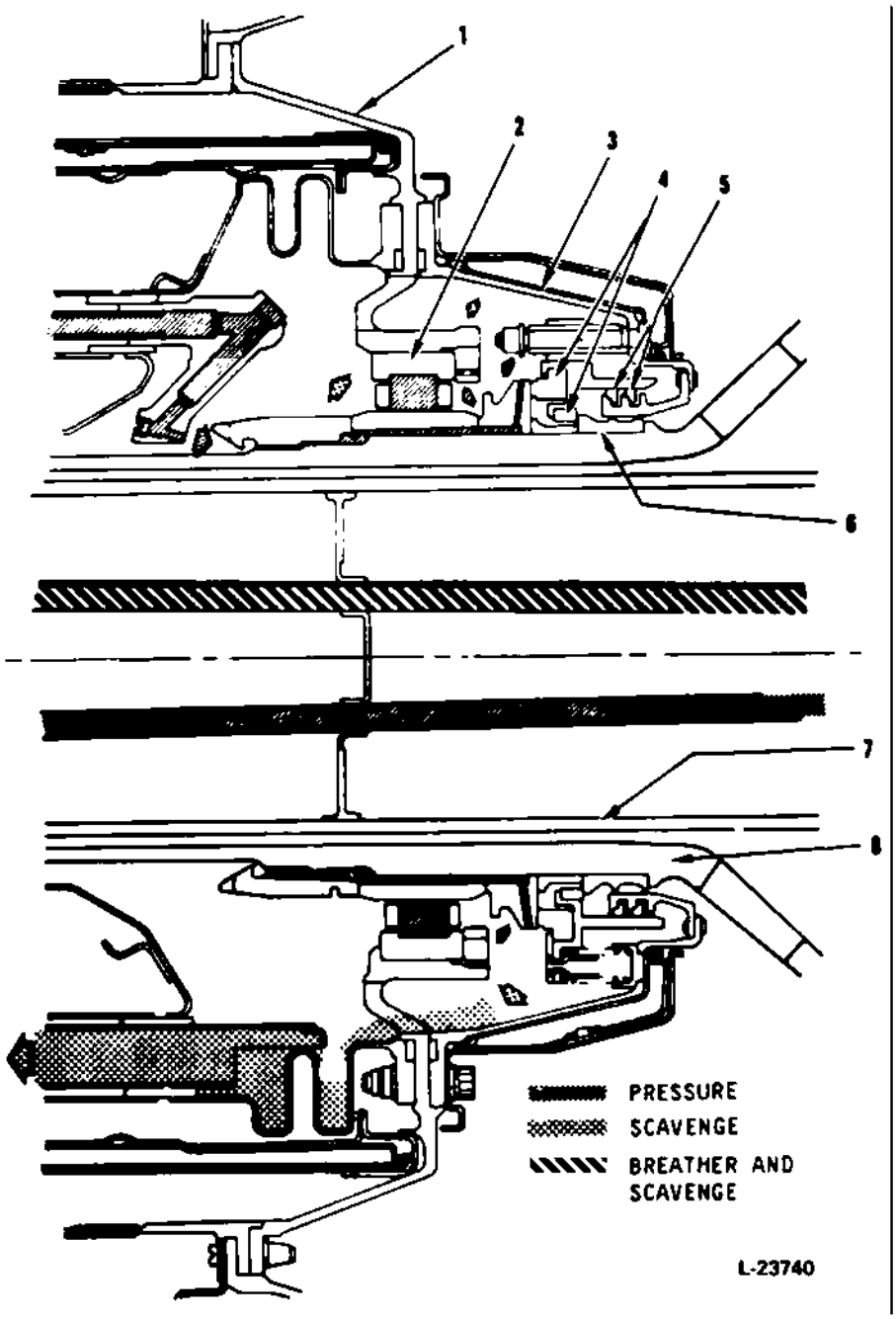
(2) Carbon-Type Seal:

(a) The No. 4 bearing seal is a face-type carbon seal with two sealing elements facing in opposite directions. These carbon elements each ride against rotating seal plate surfaces, and tandem metal sealing rings control oil flow around the carbon seals. Two rotating knife-edge seals on the rear compressor rear hub control rotor airflow into the bearing compartment. Heat shielding around the seal area protects the bearing compartment from excessive heat, and a seal drain tube at the 6 o'clock position on the front of the seal assembly conducts excessive accumulations of oil and oil vapor away from the seal.



1. No. 4 1/2 Bearing
2. Seal Housing
3. Oil Pressure And Scavenge Tube Assembly
4. Inner Race Retaining Nut
5. Coupling
6. Spring (3)
7. Thrustring (6)
8. Seal Housing
9. Spacer
10. Seal
11. Spring Washer (3)

No. 4 1/2 Bearing,
Seals, And Lubrication
Figure 10
(Task 72-00-00-990-012)



No. 5 Bearing, Seals,
And Lubrication
Figure 11 (Sheet 1)
(Task 72-00-00-990-012)

1. No. 5 Bearing Housing
2. No. 5 Bearing
3. Seal Support Assembly
4. Oil Seals
5. Seal Rings
6. Airseal
7. Front Compressor Drive Turbine Shaft
8. Rear Compressor Drive Turbine Shaft

Key to Figure 11 (Sheet 1)

G. No. 4 1/2 Bearing Seal (Split-Ring Type)
See Figure 10.

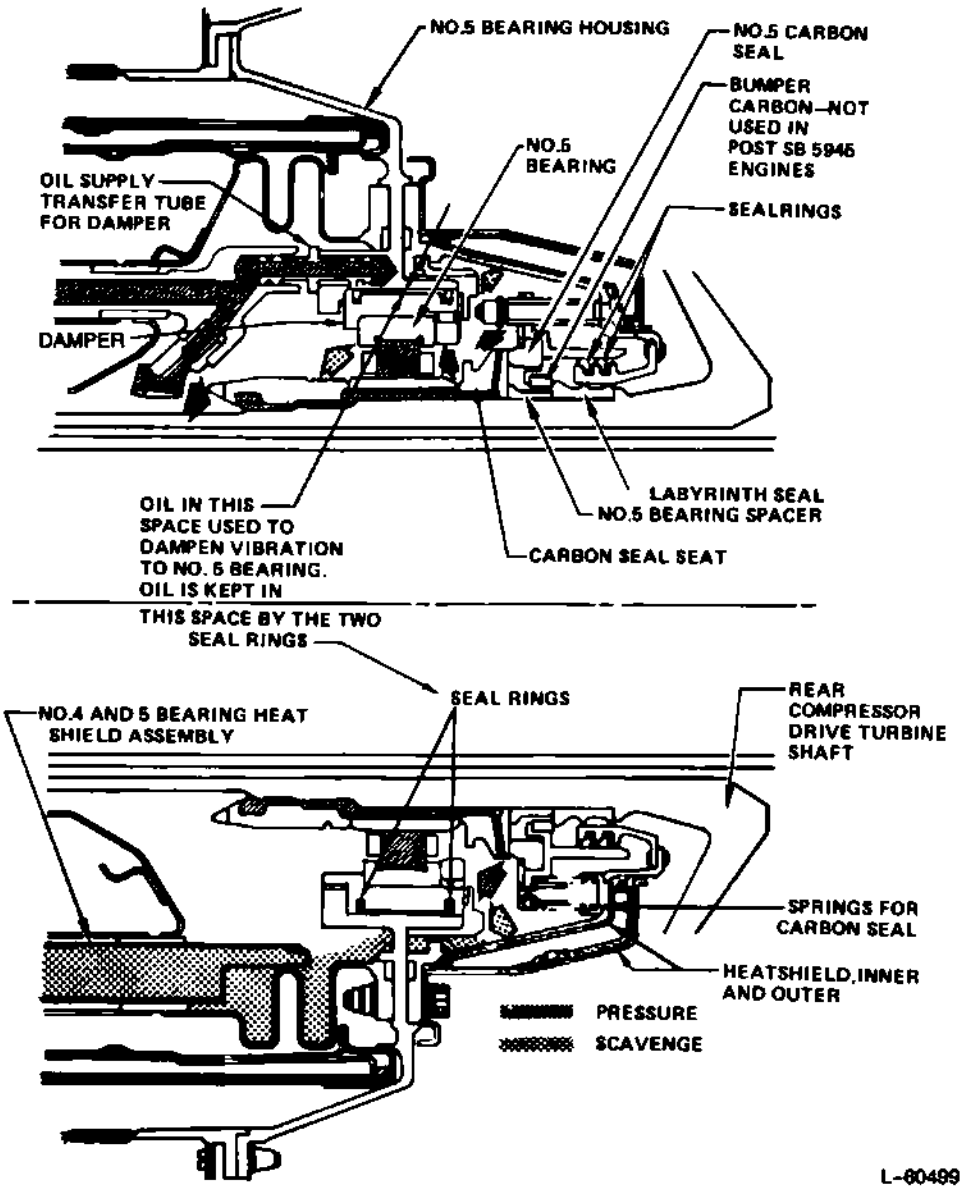
(1) This seal consists of bonded graphite ring seals mounted between spacers on the front compressor drive turbine rotor shaft and rotating within the bore of the rear compressor drive turbine rotor shaft. The split ring seals are forced outward against the bore of the rear compressor drive turbine shaft by centrifugal force and by gas pressure acting on the inner diameter. The gas pressure acting on the face of each seal ring forces the other face against the adjacent spacer.

H. No. 5 Bearing Seal (Face Type)
See Figure 11.

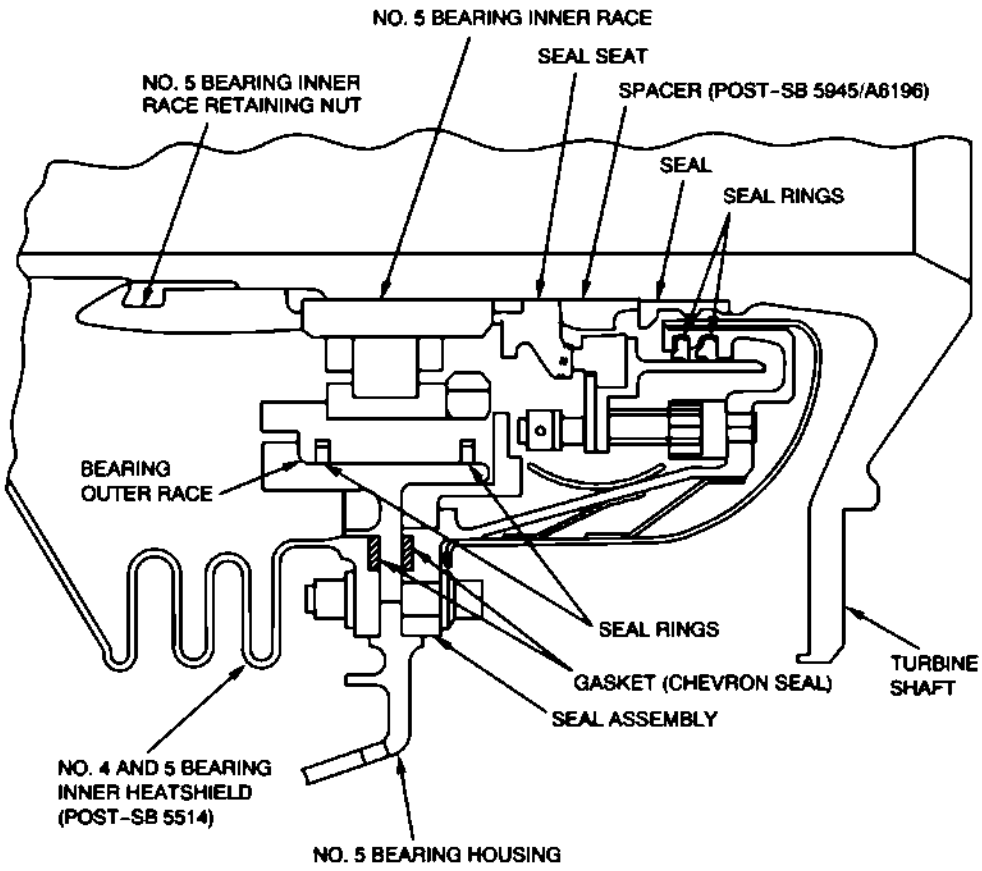
(1) This seal consists of a hardfaced (flame coated) seat, mounted on the rear compressor drive turbine rotor, which rides against one of two carbon seals mounted in a spring-loaded support. The forward face of an airseal on the rotor shaft rides against the other carbon seal. The seal support incorporates two metal seal rings inside the rear of the seal assembly and a heatshield over its outer surface.

I. No. 6 Bearing Seal (Split-Ring Type)
See Figure 12.

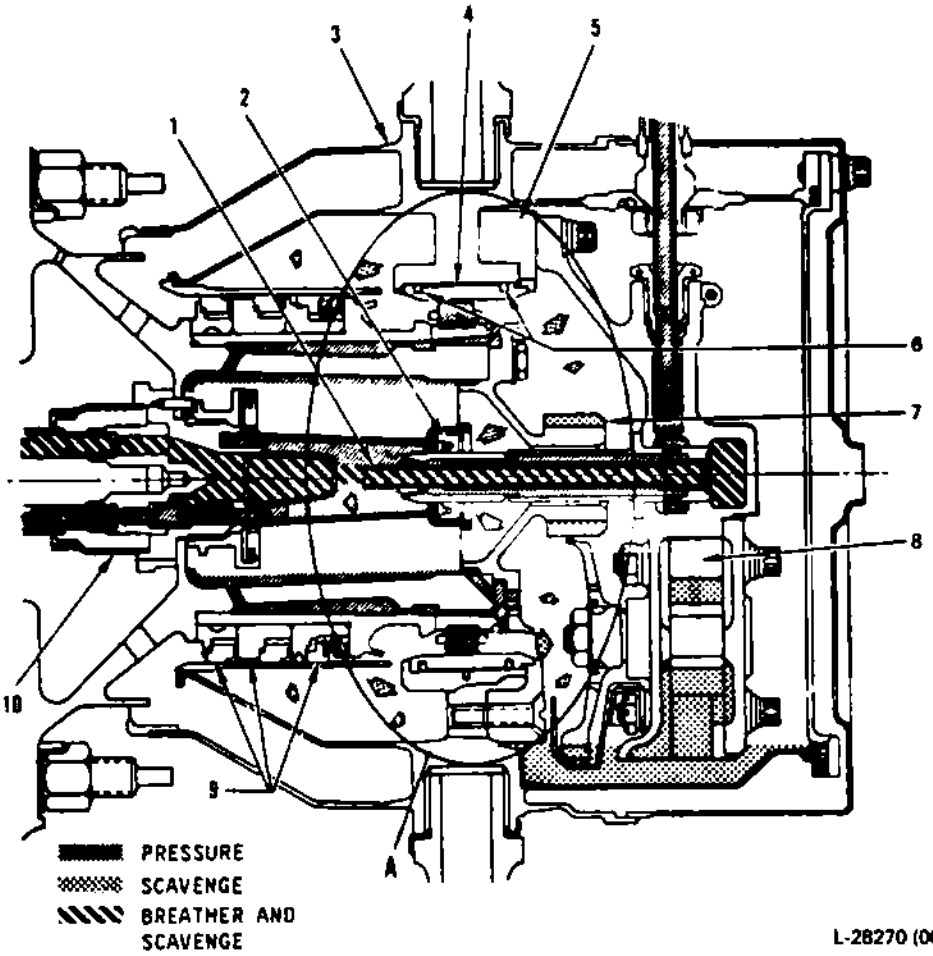
(1) This seal consists of bonded graphite ring seals mounted between spacers on the front compressor drive turbine rotor rear hub and rotating within the bore of a stationary seal housing welded inside the No. 6 bearing support. The split ring seals are forced outward toward the bore of the stationary housing by centrifugal force and by gas pressure acting on the inner diameter.


NO.5 BEARING HOUSING
NO.5 CARBON SEAL
BUMPER CARBON—NOT USED IN POST SB 5945 ENGINES
NO.5 BEARING
OIL SUPPLY TRANSFER TUBE FOR DAMPER
SEALRINGS
DAMPER
LABYRINTH SEAL
NO.5 BEARING SPACER
OIL IN THIS SPACE USED TO DAMPEN VIBRATION TO NO. 5 BEARING. OIL IS KEPT IN THIS SPACE BY THE TWO SEAL RINGS
CARBON SEAL SEAT
SEAL RINGS
NO.4 AND 5 BEARING HEAT SHIELD ASSEMBLY
REAR COMPRESSOR DRIVE TURBINE SHAFT
SPRINGS FOR CARBON SEAL
HEATSHIELD, INNER AND OUTER
PRESSURE
SCAVENGE
L-60499 (0508)
PW C

No. 5 Bearing (Oil Damped)
Figure 11 (Sheet 2)
(Task 72-00-00-990-012)

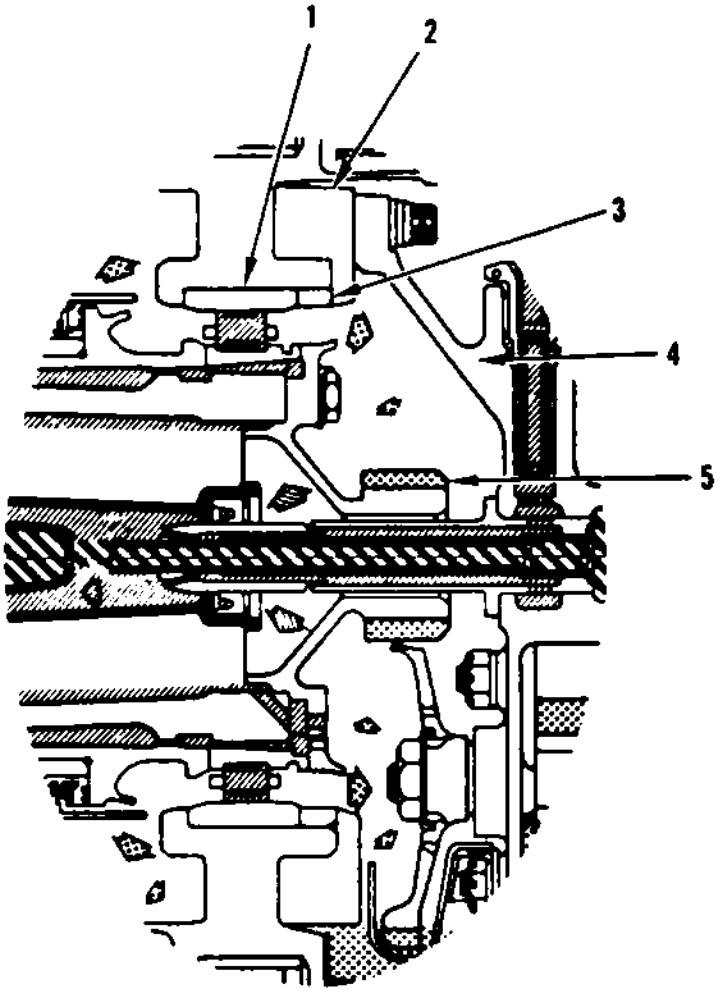


No. 5 Bearing Area
R (Current Configuration)
R Figure 11 (Sheet 3)
(Task 72-00-00-990-012)



1. Oil Nozzle
2. Seal
3. No. 6 Bearing Housing Assembly
4. No. 6 Bearing
5. Retaining Plate
6. Seal Rings
7. Scavenge Pump Gearshaft
8. No. 6 Bearing Oil Scavenge Pump
9. No. 6 Bearing Seals
10. No. 4 1/2 and 6 Bearing Shield and Tube Assembly

No. 6 Bearing Seals and
Lubrication (Oil-Damped Bearing)
Figure 12 (Sheet 1)
(Task 72-00-00-990-012)



1. No. 6 Bearing Outer Race
2. Retaining Plate
3. Spacer
4. No. 6 Bearing Oil Scavenge Pump
5. Scavenge Pump Spur Gearshaft

No. 6 Bearing Lubrication
(Non-Oil-Damped Bearing)
Figure 12 (Sheet 2)
(Task 72-00-00-990-012)

(2) The gas pressure acting on one face of each seal ring forces the other face against the adjacent spacer. Relief holes through the sealing faces of the carbon rings prevent the pressure differential across a seal from giving an excessive closing force. There is also a steel-reinforced rubber oil seal mounted in the end of the oil pressure tube. This seal fits around the OD of the nozzle assembly and confines pressure oil within the oil pressure tube.

Task 72-00-00-990-014:

13. LUBRICATING SYSTEM

A. General

(1) The engine lubrication system is of a self-contained, high pressure design consisting of a pressure system which supplies lubrication to the main engine bearings and to the accessory drives, and a scavenge system by which oil is withdrawn from the bearing compartments, and from the accessories, and then returned to the oil tank. A breather system connecting the individual bearing compartments and the oil tank completes the lubrication system. See Figure 13.

B. Pressure Oil System

(1) Oil is gravity fed from the oil tank into the main oil pump within the gearbox. The pressure section of the main oil pump forces oil through the main oil strainer located immediately downstream of the pump discharge. The main oil strainer filter element is a stacked disk type, a reusable filter element, or a disposable filter element. A bypass valve is incorporated in the center of the filter element. If the filter element becomes clogged, the bypass valve will move off its seat and the oil will bypass through the center of the filter.

(2) Proper distribution of the total oil flow to the various locations is maintained by metering orifices and clearances. The main oil pump is regulated by a valve to maintain a specified pressure and flow. Pressure, relative to internal engine breather pressure (tank pressure), and flow are essentially constant with changes in altitude and engine speed.

(3) Oil leaves the gearbox and flows to the fuel-coolant oil cooler. If the cooler is blocked, an oil cooler bypass valve opens to permit the continuous flow of oil. Oil leaves the cooler (or passes through the valve) and flows into the oil pressure tubing to the main bearing compartments. The pressure sense line maintains a constant oil pressure at the bearing jets, regardless of the pressure drop of the oil at the fuel oil cooler.

C. No. 1 Bearing Lubrication
See Figure 6.

(1) Oil for the No. 1 bearing enters the inlet case through a tube in the bottom vane.

(2) For engines equipped with oil dampened No. 1 bearing, a transfer tube from the front accessory support leads back into the bearing support to supply oil to a cavity around the bearing outer race.

(3) The remainder of the oil moves up the tube and is then routed, through a small strainer in the front accessory drives support, into the accessory drives gearshaft. It moves to the outer wall of the gearshaft and through holes in that wall; then through holes in the front hub and inner race retaining nut to the front of the No. 1 bearing.

D. No. 2 and No. 3 Bearings Lubrication
See Figure 7.

(1) Oil enters the No. 2 and 3 bearing compartment through a small strainer and is sprayed onto the bearings through a three-legged oil nozzle assembly. A front leg (or nozzle) directs oil toward the No. 2 bearing, a second toward the No. 3 bearing, and a third toward the gearbox drive shaft upper bearing. Oil flows through holes in the rear hub to the ID of the No. 2 bearing. Flow through the gearbox drive bevel gear holes carries oil to the ID of the No. 3 bearing.

E. No. 4 and 5 Bearings Lubrication
See Figures 9 and 11.

(1) Pressure oil for the No. 4 and 5 bearings locations flows into the engine through a tube at the eight o'clock location, left side of the fan discharge diffuser outer duct. It then flows upward around the diffuser case to the ten o'clock position and inward (through the inner passage of dual concentric pressure and breather tubing) to the No. 4 bearing support. Here it is directed rearward through an elbow and flows into the multi-passage No. 4 bearing oil nozzle assembly.

(2) The No. 4 bearing oil nozzle assembly has an inlet passage, outlet holes at the bottom directing oil toward the No. 4 bearing, and an outlet passage toward the rear. An oil strainer is positioned inside the inlet passage. The outlet passage toward the rear accommodates the long oil tube of the No. 5 bearing oil nozzle assembly. Oil passes rearward through this tube and is then directed through the No. 5 bearing oil nozzle assembly. From the oil nozzle it passes under the bearing race and through the seal plate to the No. 5 bearing compartment. See Figure 14.

F. No. 4 1/2 and 6 Bearings Lubrication
See Figures 10 and 12.

(1) Oil flows to the No. 6 bearing area through a tube located in the upper turbine exhaust strut and down into the No. 6 bearing scavenge pump housing. In the scavenge pump housing it passes through a small strainer then down into the outer passage of the No. 6 bearing oil nozzle assembly.

(2) For engines having oil damped No. 6 bearings, oil flows from the oil scavenge pump through a tube to the No. 6 bearing housing. The oil is then distributed to a cavity formed between the housing and the bearing outer race. Seal rings around the bearing outer race help contain oil in the cavity.

(3) The oil flows forward in the oil nozzle outer passage and divides into two streams. One stream flows outward, through small holes on the OD of the nozzle outer passage tube to lubricate the No. 6 bearing area. From the same nozzle outer passage tube the other stream continues forward through holes on the nozzle outer front face and into the outer passage of the turbine bearings oil pressure and scavenge tubes assembly (oil trumpet) inside the front compressor

drive turbine rotor. The oil continues forward through the single (short) pressure tube in the oil trumpet to the No. 4 1/2 bearing area.

(4) The outward stream, for the No. 6 bearing area as previously mentioned, flows into the front compressor drive turbine rotor rear hub. Through two sets of holes in the hub it flows to the No. 6 bearing seals and to the No. 6 bearing inner race.

(5) The pressure oil in the oil trumpet flows forward and out through an oil baffle then through holes in the long turbine shaft to cool the No. 4 1/2 bearing seal spacers and lubricate the No. 4 1/2 bearing.

G. Scavenge Oil System

(1) General

(a) The scavenge oil system of the engine includes four gear-type pumps (five pump stages) which scavenge the main bearing compartments and deliver the scavenged oil to the engine oil tank.

(2) No. 1 Bearing Compartment See Figure 6.

(a) The single stage scavenge pump for the No. 1 bearing compartment is located in the cavity of the front accessory drive housing. The pump is driven by the front accessory drives gearshaft located in the front hub of the front compressor rotor. The pump picks up the oil and sends it outward through a passage in the housing then down a tube located in the bottom vane of the inlet case.

(3) No. 2 and 3 Bearing Compartment See Figure 7.

(a) The second pump is located in the scavenge stage of the main oil pump assembly in the accessory drive gearbox. Gearbox drive shaft bearings and No. 2 and No. 3 bearing scavenge oil, which drains down the outside of the accessory drive shaft, is pumped from its collection point in the gearbox. One bevel gear drives both the scavenge and pressure stages in this pump.

(4) No. 4, 4 1/2, and 5 Bearings Area See Figures 9, 10, and 11.

(a) The third pump, with two stages driven by the same gear, is the No. 4 and 5 bearings oil scavenge pump assembly, located inside the diffuser case. Together, the two stages of the pump scavenge the oil from the No. 4, 4 1/2, and 5 bearing areas. In addition, scavenge oil from the No. 6 bearing area, after flowing forward through the two long scavenge tubes in the oil trumpet, flows into this compartment. A tube in the combustion chamber heatshield allows passage of the oil forward from the No. 5 bearing cavity.

(b) The discharge from the pump is carried forward into the scavenge adapter at just below the 9 o'clock position in the No. 4 bearing support then outboard. It flows outboard, through the inner tube of dual concentric tubing (shared with a breather passage) to the outside of the diffuser case. From the outside of the diffuser case the oil flows downward to the eight o'clock position where it is then routed through the fairing to the outside of the diffuser outer duct.

(5) No. 6 Bearing Compartment See Figure 12.

(a) The fourth scavenge pump is located in the No. 6 bearing scavenge pump housing where it is driven by a gearshaft bolted to the rear of the turbine rotor fourth stage rear hub. It scavenges oil from the No. 6 bearing compartment and pumps it upward into the inner passage of the No. 6 bearing oil nozzle assembly.

(b) The oil flows forward in the oil nozzle inner passage and is discharged through the center hole in the front of the nozzle. It passes forward into the inner passage of the oil trumpet and continues forward through the two long scavenge tubes as previously mentioned. At the front of the trumpet, the oil flows outward through holes in the front compressor drive turbine shaft and in the front of the No. 4 1/2 bearing inner race retaining nut. The oil is then spun outward through holes in the rear compressor drive turbine shaft and into the No. 4 bearing cavity.

(c) Return oil passed forward by the two rearmost pumps, as well as that from the front oil suction pump, is directed into the gearbox cavity. From here the oil is pumped, by the scavenge stage of the gearbox pump, to the oil tank. Within the tank, the oil passes through a deaerator where the major part of the entrapped air is removed.

H. Breather System

(1) To ensure proper oil flow and to maintain satisfactory scavenge pump performance during operation, the pressure in the bearing cavities is controlled by the breather system. The atmosphere of the No. 2 and 3 bearing cavity vents into the accessory gearbox. Breather tubes in the compressor inlet case and diffuser case discharge through external tubing into the accessory drive gearbox. Breather air from the No. 6 bearing compartment comes forward through the oil pressure and scavenge tubes assembly (oil trumpet), with the scavenge oil from that compartment, to the diffuser case cavity.

(2) In the gearbox, vapor-laden atmosphere passes through rotary breather impellers, mounted on the starter drive gearshaft, where the oil is removed. The relatively oil-free air reaching the center of the gearshaft is conducted overboard.

Task 72-00-00-990-015:

14. AIR SYSTEMS

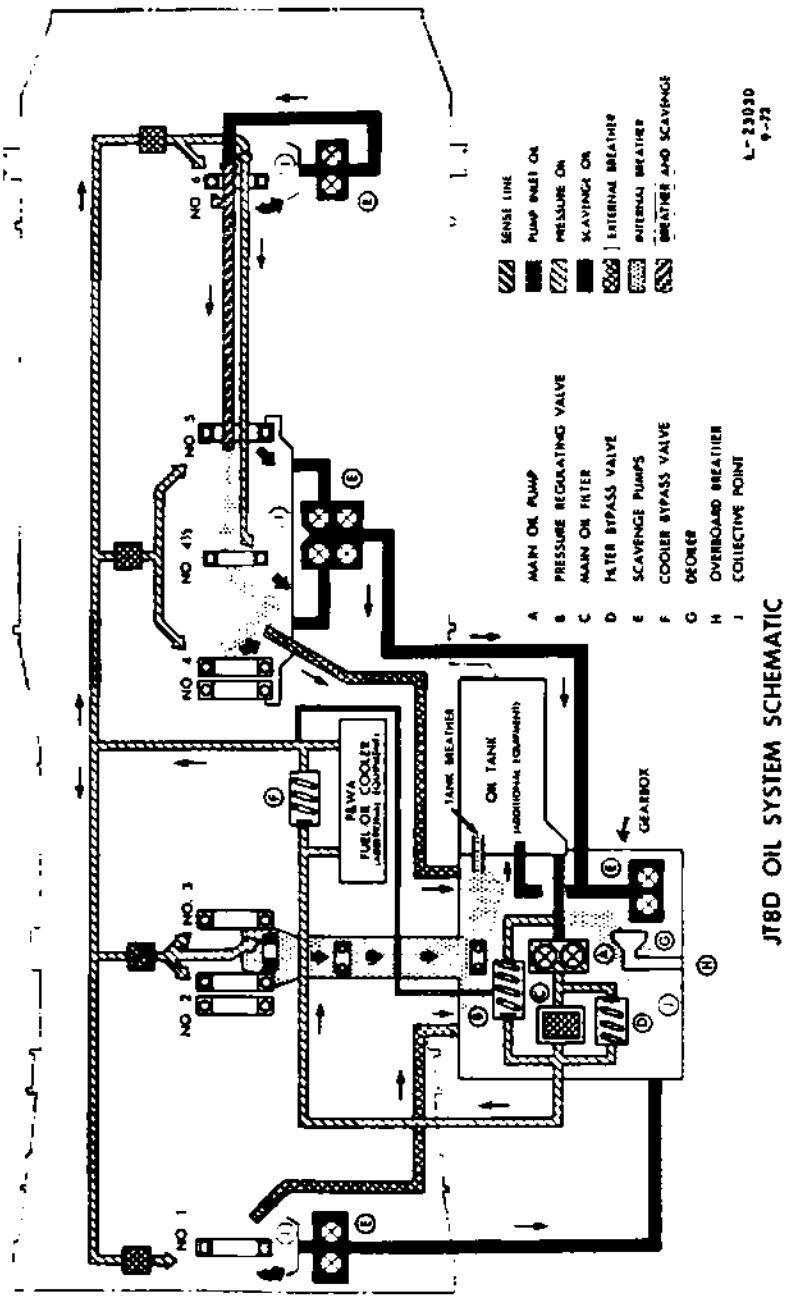
A. Anti-Icing Air System

(1) This system is provided to prevent undesirable icing of the engine air inlet surfaces. This is accomplished by piping hot air (eighth stage bleed) forward to the inlet section. See Chapter 75 for a detailed description of this system.

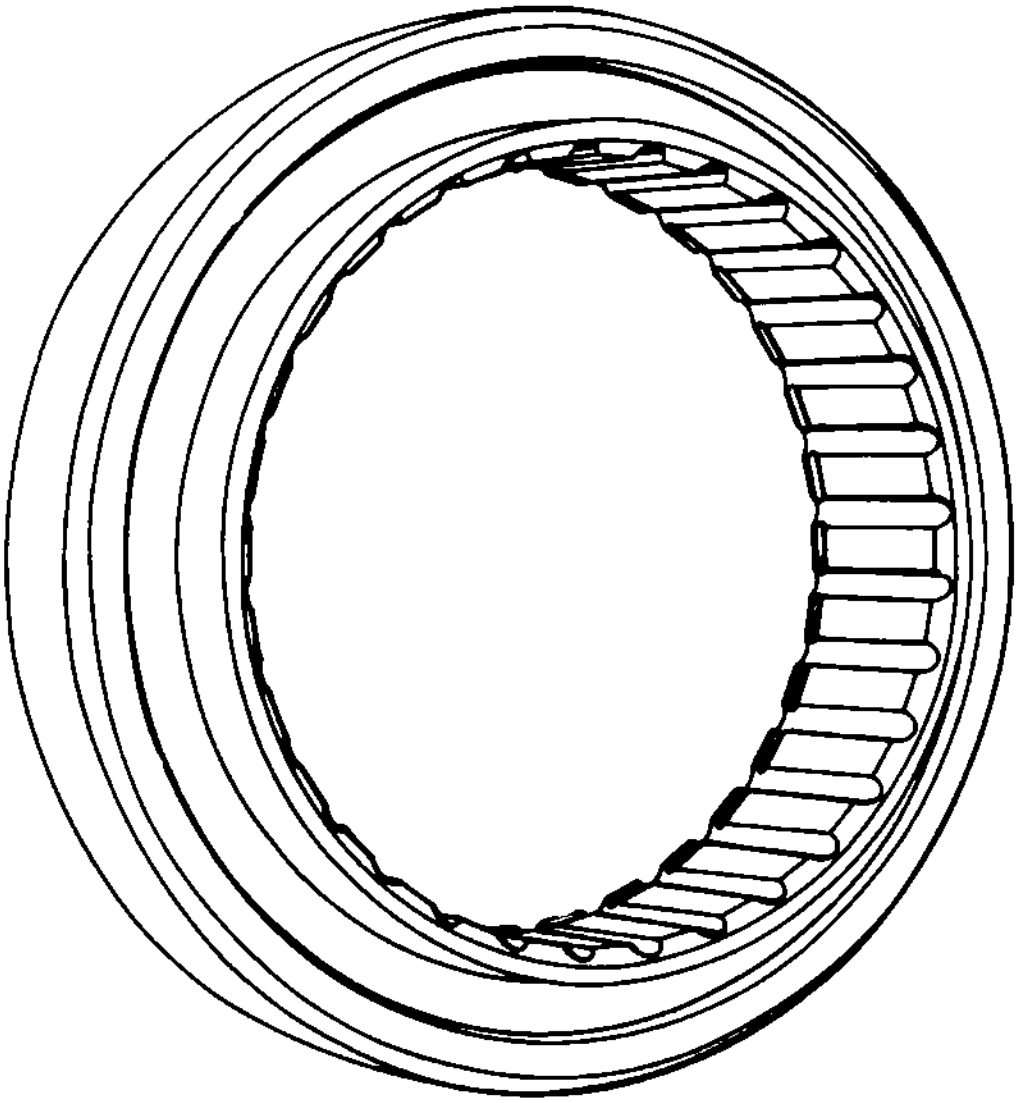
B. Compressor Bleed System

(1) The compressor bleed air system is primarily designed to permit operational flexibility by allowing 8th and 13th stage air to bleed overboard. See Chapter 75.

C. Cooling Air System
See Figure 15.



Oil System Schematic
Figure 13
(Task 72-00-00-990-014)



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Under-Race Oil Grooves
Figure 14
(Task 72-00-00-990-014)

(1) Cooling air for the interior of the combustion chamber and turbine area is thirteenth stage compressor air which passes between the multi-edged airseal on the rear of the thirteenth stage disk and the mating seal rings at the inner shroud of the exit vanes. This air enters the diffuser case inner cavity, formed by the rear compressor rear hub and the diffuser inner inlet duct, and goes rearward between the combustion chamber inner case and the turbine shafts heatshield. From this area it passes through holes in the No. 5 bearing housing.

(2) A tubing system from the diffuser case inner cavity to the upper left boss on the diffuser outer fan duct provides a means to measure the turbine cooling air pressure.

(3) A portion of the air passes between the first stage turbine disk (front side) and airseal and through holes in the first stage disk and blades. The rest of the air passes through holes located just aft of the disk front flange cooling the disk rear face. A portion of 6th stage compressor air escapes via the interstage airseal, while the remainder of cooling air enters the front compressor drive shaft and circulates around the turbine disks before passing outward through the rear hub. Cooling air passes around the No. 6 bearing support housing and the sump heatshield as well as joining the engine exhaust gas flow ahead of the exhaust struts.

(4) At the No. 4 bearing compartment when the seal is of the labyrinth type, the seal air tubes hold down the bearing compartment temperature by bleeding hot air before it can reach the compartment. See "Main Shaft Oil And Airseals" in this section.

D. Labyrinth Seal Air System

(1) The No. 2, 3, and 4 bearing seals utilize an air system to facilitate their function. The air tubes, and their function, are described with "Cooling Air System" and "Main Shaft Oil and Airseals" in this section.

E. Internal Bleed Air System

(1) In order to achieve a partial balance of thrust and maintain pressure on oil sealing areas, some compressor air is allowed to fill interior areas.

(2) A small amount of sixth stage air passes between the No. 2 bearing support and the rear of the sixth stage disk. This air maintains a pressure upon the front of the No. 2 bearing seals and also passes forward through holes in the front compressor rear hub then forward into the front hub to maintain pressure at the No. 1 bearing seal.

(3) Ninth stage air is admitted through holes in the interstage spacer, aft of the interstage seal, to the interior cavity of the rear compressor rotor. Because of holes in the rotor front hub and a three-edged seal on the front face of the seventh stage disk, air pressure is maintained upon the No. 3 bearing seals.

(4) The maintenance of pressure approximately equal to the ninth stage discharge pressure on the area within the seal diameter at the forward end of the rear compressor achieves a partial balance of the thrust on the rear compressor rotor. Aft of the rear compressor, the engine cooling air also functions to maintain a pressure on the seals.

Task 72-00-00-990-016:

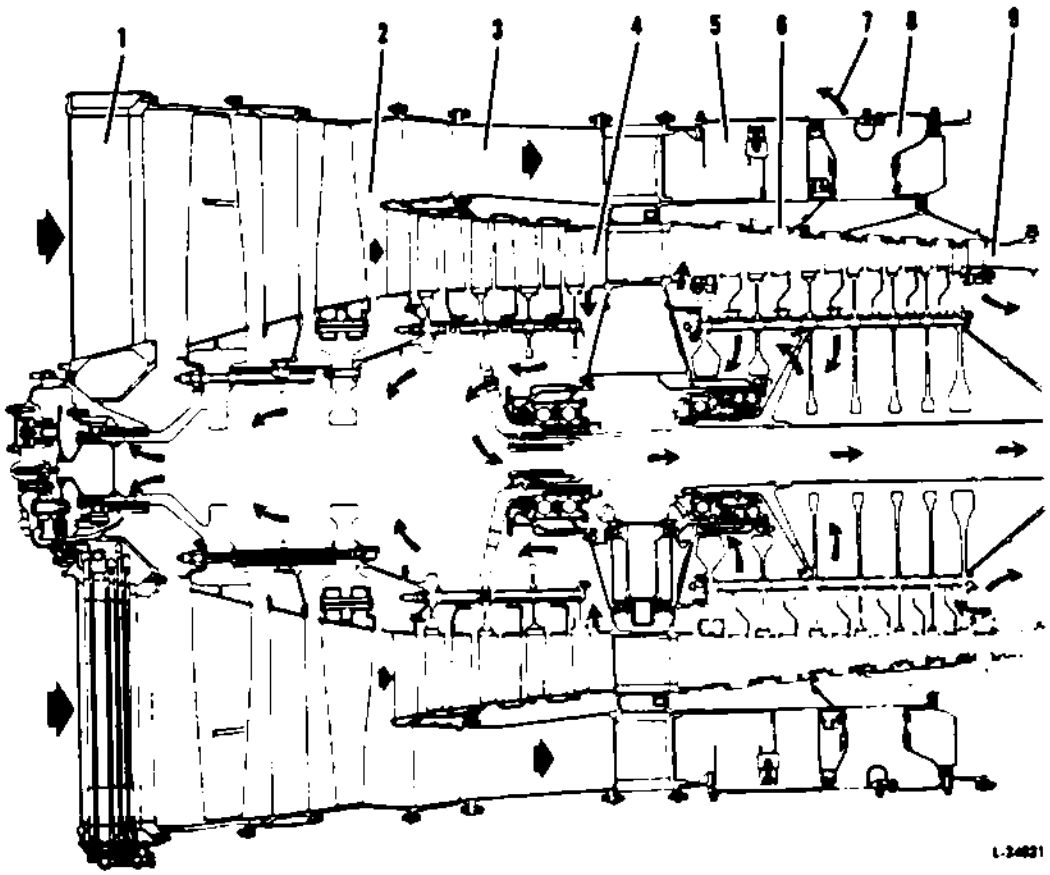
15. FUEL SYSTEM

A. General

(1) The engine fuel system is designed to permit selection of a desired engine power requirement and to automatically provide the proper amount of fuel to the burners. See Chapter 73 for a detailed description of this system.

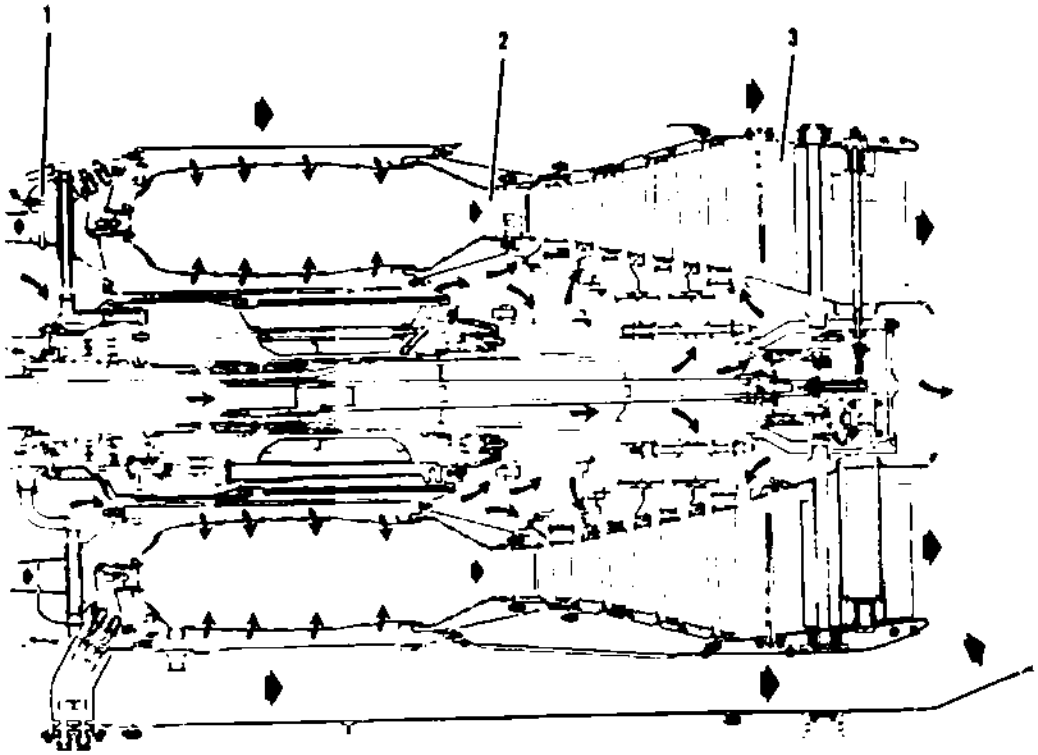
B. Vibration Pickup Brackets

(1) The engine is equipped with a vibration pickup bracket on the compressor case front flange (flange B) and bracket pickup boss at the six o'clock position between the mount flanges of the fan discharge turbine exhaust outer duct.



1. Fan Inlet Air (Pt2, Tt2)
2. Low Pressure Compressor (N1)
3. Fan Discharge Air
4. Low Pressure Compressor Discharge Air (Pt3, Tt3)
5. Low Pressure (N1) Bleed Air
6. High Compressor (N2)
7. Anti-Icing Air
8. 8th Stage Bleed Air
9. High Pressure Compressor Discharge Air (Pt4, Tt4)

Gas Flow Diagram
Compressor Section
Figure 15 (Sheet 1)
(Task 72-00-00-990-015)



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1. High Pressure (N2) Bleed Air and Fuel Anti-Icing
2. Combustion Chamber Discharge Air (Pt5, Tt5)
3. Turbine Discharge Air (Pt7, Tt7)

Gas Flow Diagram Combustion
Section and Turbine Section
Figure 15 (Sheet 2)
(Task 72-00-00-990-015)

Task 72-00-00-990-017:

16. ENGINE DATA AND TRIM SPEED PLATES

A. General

(1) The engine identification data plate is located on the right side of the accessory and component drives gearbox. The engine trim speed data plate is positioned on the front flange (front face) of the engine rear mount ring on the right side.

Task 72-00-00-810-001:

1. General

   A. Troubleshooting is a process of identifying engine problems through observation and evaluation of engine behavior. When an engine develops a problem, maintenance personnel must evaluate the symptoms and identify the cause of the problem, using evidence which supports a certain cause or disqualifies other causes. In order to save time, the most probable cause, as determined by maintenance experience and by the recommendations of this section, should be examined first. If review of engine records indicates a previous maintenance action or frequent repetitive actions, this indicates a need for more extensive troubleshooting.

   B. Before attempting to work on an engine which has been reported as malfunctioning, it is important to know as much as possible about the engine. Not only is the engine's behavior at the time of its malfunctioning important, but also the recent history of the engine, together with the engine's response to troubleshooting action, should be considered. Recent engine history includes information such as flight crew reports, maintenance actions, time since overhaul or major component replacement, time since the last trim or ground check, or the relationship in service time between the engine and other engines in the aircraft. Consult the pilot's flight report, engine log books, engine condition monitoring data and any other available sources. It is important that all of these sources of information be used, analyzed and coordinated to formulate the most appropriate maintenance action.

   C. These troubleshooting procedures are prepared with the assumption that maintenance personnel are familiar with the design and structure of the JT8D Turbofan engine. See the Description sections in the engine and accessory component chapters for details on the various areas of the engine.

   D. Approved removal and installation procedures for various engine parts and components are described in their respective sections in this manual. Special assembly procedures, special torques, etc. are listed in "Fits and Clearances" portions of applicable Removal/Installation or Inspection/Check sections; all maintenance procedures not covered by special limits shall conform to the techniques and limits in the "Standard Maintenance Practices" portion of Chapter/Section 72-00, Removal/Installation.

Task 72-00-00-810-002:

2. Troubleshooting Section Structure

A. Troubleshooting procedures are divided into sections related to engine areas in which problems are found, as follows:

(1) Troubleshooting-02, Lubrication System: This section has procedures for problems related to oil pressure, temperature, or leakage. There are procedures for these problems:

(a) High Oil Consumption

(b) High Oil Temperature

(c) Oil Filter/Strainer Differential Pressure Light On

(d) Black Oil

(e) Oil Fumes In The Aircraft Cabin

(f) Oil Pressure Problems (Low/No Oil Pressure, Fluctuating Oil Pressure, Oil Pressure Follows The Power Lever, High Oil Pressure)

(2) Troubleshooting-03, Engine Indication System: This section has procedures for problems related to the engine pressure and temperature indication systems. There are procedures for these problems:

(a) Engine Exhaust Gas Temperature (EGT) problems (EGT Indication Does Not Operate, Or EGT Indication Is High Or Low Compared To Other Engine Parameters)

(b) Engine Pressure Ratio (EPR) problems (EPR Is Low Or Not Stable)

(3) Troubleshooting-04, Power and Engine Response: This section has procedures for problems related to engine performance and operation levels. There are procedures for these problems:

(a) Low Idle N2

(b) Surge (Off-Idle, High Power/Takeoff/Steady State, Deceleration Surge)

(c) Slow Acceleration

(d) Unable To Reach Takeoff Power

(e) Start Problems (No Start, Hot Start, Hung Start)

(f) Engine Flameout

(g) Auto-Acceleration

(h) Fuel Filter Differential Pressure Light Stays On With Fuel Heat

(i) Fuel Temperature Does Not Increase with Fuel Heat (Douglas DC-9 Installations Only)

(4) Troubleshooting-05, Engine Vibration: This section has procedures for engine vibration problems, N1 and N2 type.

B. The scope of this section is to locate the cause of engine malfunction and to prescribe corrective action. Detailed inspection and check procedures on engine subassemblies and accessory components are found in the applicable engine or accessory component subsection of this manual; where detailed inspection of a subassembly or component would be helpful and practical in troubleshooting the engine, specific reference will be made to the section in which that procedure is found.

C. For detailed treatment of engine-related systems not part of the basic JT8D engine, consult the applicable airframe maintenance manual.

Task 72-00-00-810-003:

3. Subsystem Troubleshooting Procedures

A. Operational inputs provided by flight crews and by maintenance crews can be very valuable to personnel who are troubleshooting engine malfunctions. Typical operational comments on specific malfunctions have been incorporated to aid maintenance personnel in identifying and resolving abnormal engine operation. There are some problems which do not have any related inputs noted. In these instances no specific inputs have (as yet) been generated. Additional inputs will be added, as dictated by in-service experience, as they are developed.

B. Visual checks are included to provide what should be the first step in verifying and isolating engine problems. These checks are to be employed prior to starting any extensive systems troubleshooting. In some instances items listed as visual checks will be found in the normal problem solving sequence. However, by presenting them separately, they are highlighted so they will receive proper attention and application in the troubleshooting process. Use of visual checks will reduce the amount of time spent in solving reported engine problems.

(1) The following discrepancies are listed and defined to clarify the meaning of various conditions and expressions used in troubleshooting.

Discrepancies	Definition
Auto Acceleration	Power increases without a corresponding power lever movement.
Auto Deceleration	Power decreases without a corresponding power lever movement (engine continues to operate at reduced power).
EGT Limited	Inability to obtain desired power at Maximum EGT.
EPR Shortfall	Inability to obtain takeoff target EPR with a fully advanced thrust lever and no other parameter is limiting.
Flameout	Interruption of engine operation due to total loss of combustion while fuel control unit is in ON position as evidenced by sudden drop in EGT with rotor speeds falling to windmilling levels.
Fluctuating Power Level	Cyclic power increase and decrease without power lever movement.
Hot Start	EGT exceeds start EGT limit.
Hung Start	N2 and EGT ceases to increase before reaching normal idle N2 with no subsequent power lever response.

Discrepancies	Definition
Impending Hot Start	Start aborted due to EGT increasing at an abnormally fast rate with indication it would exceed start EGT limit if allowed to continue.
Indication Abnormal	Engine parameters (EGT, WF, N1, N2) differ appreciably from other engine(s) at comparable EPR.
Light Off	Light Off is indicated by EGT rise after start lever advance
No Light	No indicated increase in EGT after start lever advance.
N2 Limited	Inability to obtain desired EPR at N2 Orange/Redline.
Power Fluctuates	Cyclic power increases and decreases without power lever movement.
Power Lever Limited	Inability to obtain desired EPR at maximum power lever position.
Power Lever Misalignment	Power levers are not aligned for given power setting.
Slow Acceleration	Slower than normal acceleration after initial EGT rise. All engine parameters are slow to respond to power lever movement.
Slow or No Power Lever Response	Engine does not respond or is slow to respond (relative to other engine(s)) to power lever movement.
Surge	Abrupt power loss due to compressor instability which may or may not be audible and usually accompanied by EGT increase.
Wet Start	No indicated increase in EGT after start lever is advanced with fuel flow confirmed.

Task 72-00-00-810-004:

1. Lubrication System - Diagrams

A. General

NOTE: This troubleshooting section is as follows:

Symptom	Paragraph
High Oil Temperature	B
Excessive Oil Consumption	C
Oil Filter Strainer Differential Pressure (Delta P) Light On	D
Black Oil	E
Oil Fumes In The Aircraft Cabin	F
Oil Pressure Problems	G

B. High Oil Temperature

NOTE: If the engine has windmilled after an in-flight shutdown procedure, refer to "Engine Windmilling" in Adjustment/Test.

(1) Before you do this High Oil Temperature Troubleshooting procedure, it is recommended that you visually examine these three areas:

(a) Do an oil level check at the oil tank.

(b) Look at the fuel de-icing valve indicator (make sure the indicator is in the "OFF" position).

(c) Look at the No. 4 and 5 bearing scavenge tube oil temperature indicators (installed on Boeing 727 aircraft by Alert Service Bulletin 5944, or SB 6101 as applicable).

(2) Conditions in steps (a), (b), or (c) above could be the cause of high oil temperature. Go to the applicable troubleshooting step below.

(3) Procedures. See Figures 101 thru 104.

C. Excessive Oil Consumption/Oil Leakage
See Figures 105 thru 113.

NOTE: If the engine has windmilled after an in-flight shutdown procedure, refer to "Engine Windmilling" in Adjustment/Test.

(1) If oil leakage is seen on the engine or in the inlet, tailpipe, or cowling, use the procedures for Excessive Oil Consumption below to find and correct the leak.

(2) Blue dye oil leak check (optional)

(a) Use this procedure to find leaks in the oil system with a blue dye that is added to the engine oil before the leak check. This dye check is optional.

(b) It will be necessary to drain the oil from the engine after this check is completed.

(c) This check will make it possible to know the difference between oil leakage from engine seams (which is not a problem) and leakage from engine lubrication systems (which can cause engine problems).

(d) Oil system preparation

CAUTION: BE SURE TO OBEY THE TIME LIMITS IN THE OIL DRAIN PROCEDURE BEFORE THE OIL TANK CAP IS OPENED. INJURY CAN OCCUR IF THE OIL PRESSURE IS NOT RELEASED.

1 Drain the oil system (refer to the procedure in Task 72-00-00-210-015, Inspection/Check-01.

2 Prepare PS 197 blue dye/oil solution and add it to the oil tank to fill the oil system. Refer to Section 70-00-00, Standard Practices - Engine General - Inspection/Check-02 (Task 70-00-00-990-007) in the Boeing Standard Practices Manual, PN 52A323 for the procedure to prepare and mix the dye solution.

3 Clean all remaining oil from engine external surfaces, tubes, components, and accessories by SPOP 1 or SPOP 208. Refer to Chapter/Section 70-00-00 (Task 70-21-00-110-047) or (Task 70-21-00-110-040) in the Standard Practices Manual.

(e) Close the cowl doors.

(f) Start the engine (refer to Adjustment/Test-01).

(g) Set the power lever to Idle. Keep the engine at Idle until the oil is at operating temperature.

1 Let the engine become stable at minimum Idle for five minutes.

2 Make sure that all engine parameters are in the permitted limits. Refer to Adjustment/Test-01.

3 Do an engine shutdown. Refer to Adjustment/ Test-01.

4 Open the cowl doors.

5 Do a visual inspection of the engine for leaks. Blue fluid at tube joints or components will be an indication of internal oil leakage.

NOTE: Leakage which has an amber color is a result of assembly fluid leakage. Blue fluid leakage is the result of engine oil leaks.

6 Look at the seal drains for indications of blue oil leakage. Refer to the Boeing Maintenance Manual, Chapter/Section 71-71-00, Engine Vents and Drains for the locations of these drains.

7 When necessary repair the leaks in tubes or components. After the leaks are repaired, clean the dye indications by SPOP 1 or SPOP 208 and do the leak check check at Idle power again.

NOTE: It is possible that it will be necessary to operate the engine for a longer time and at higher power to see the wet indications of oil leaks. Keep the

engine operation to a minimum to prevent too much leakage.

8 When leak checks are satisfactory, go on to Procedure After Leaks Are Repaired below.

(h) Optional Takeoff Power Leak Check procedure

NOTE: This high power check is not necessary if all leaks were found by the Idle power leak check above.

1 Start the engine (refer to Adjustment/Test-01).

2 Let the engine become stable for five minutes at minimum Idle.

3 Make sure that all engine parameters are in the permitted limits. Refer to Adjustment/Test-01.

4 Set the power to 1.3 EPR and stay at this power level for 2 - 3 minutes.

5 Do an engine shutdown. Refer to Adjustment/ Test-01.

6 Open the cowl doors.

7 Do a visual inspection of the engine for leaks. Blue fluid at tube joints or components will be an indication of internal oil leakage.

NOTE: Leakage which has an amber color is a result of assembly fluid leakage. Blue fluid leakage is the result of engine oil leaks.

8 Look at the seal drains for indications of blue oil leakage. Refer to the Boeing Maintenance Manual, Chapter/Section 71-71-00, Engine Vents and Drains for the locations of these drains.

9 When necessary repair the leaks in tubes or components. After the leaks are repaired, clean the dye indications by SPOP 1 or SPOP 208 and do the leak check check at Takeoff power again.

10 When leak checks are satisfactory, go on to Procedure After Leaks Are Repaired below.

R (i) Procedure after all leaks are repaired

1 After all leaks are repaired, drain the blue-dye oil from the oil system. Refer to the procedure in Adjustment/Test-01.

2 Remove the main oil filter or strainer (refer to Task 72-00-00-210-015, Inspection/Check-01). Install a new filter or strainer.

NOTE: Service the oil system before the engine is returned to service.

3 Fill the oil system with clean oil. Refer to Inspection/Check-01.

4 Start the engine (refer to Adjustment/Test-01).

5 Operate the engine at minimum Idle for three minutes or more.

6 Do a shutdown procedure (refer to Adjustment/Test-01).

7 Do a check of the repaired areas for leaks. No leaks are permitted.

D. Oil Filter Strainer Differential Pressure (Delta P) Light On

(1) General

NOTE: If the oil filter differential pressure light comes on in the flight deck, defects in the indicating system or blockage in the main oil filter/strainer is usually the cause. If one of these above was usually the cause in the past, the best thing to do is to try the same procedure that corrected the problem before, again.

NOTE: Oil temperature less than 77°F (25°C) can also cause the oil filter differential pressure light to come on after the engine is started. However after the oil becomes warm (within five minutes), the "delta P" light will usually go off.

NOTE 1: Operator experience shows that inspection of the chip detectors is very sensitive. When bearing damage starts, very small particles will become free and move through the oil system into the chip detectors. It is difficult to identify these particles, and careful analysis is necessary. A microscope with binocular magnification will make this analysis easier. When a bearing is "spalled", particles broken away from the surface will be shiny, flat flakes. One face of these flakes will be different from the other when you look at it, and the surface finish of the two sides will be different. The outer surface of a flake of a spalled bearing is highly polished and can have parallel impressions, but the inner side will have a rough, granular texture with waves. These particles will be thin, thinner at the edges, and with cracks. When the outer layer of the bearing surface is damaged, the material under this surface starts to break into small particles. This will cause a rougher and darker surface. The flake from a spalled bearing is usually harder and less ductile than other metal particles. If it is not known where a chip came from, spectrographic analysis or chemical tests are recommended. See Servicing for metal particle identification procedures.

NOTE 2: It is possible to find both oil coke and carbon seal material in the oil filter or strainer. It is sometimes very difficult to see the difference between oil coke and carbon seal material during visual inspection, unless the particles are so large that it is possible to see by the shape that they are pieces of a carbon seal (for example a seal lip). Most of the time however, the particles found are small particles which make a sludge when mixed with the oil. If these particles are porous, low in density, and easily broken, it is very possible that the material is oil coke. If the particles are hard and not porous, and are apparently chips, it is very possible that the material is pieces of carbon seal. A carbon seal in bad condition will frequently make the oil condition worse, and this will cause oil coke. Because of this it is recommended to do the analysis of oil coke or contamination with laboratory procedures.

(2) Procedures. See Figure 114 thru Figure 116

E. Black Oil

R
R

(1) General: Black oil is usually the result of oil system contamination and/or oil that became too hot. Although contamination or high oil temperature do not occur very often, contamination can come from hydraulic fluid which was put in error into the oil tank. High oil temperature is the result of continued high internal engine temperatures. If the oil got too hot or has hydraulic fluid contamination, the oil can have a strong odor related the black oil condition, and the oil can become thick. Oil can also apparently become dark as a result of coke or carbon particles in the oil system which become loose and go into the oil as it flows through the system. This type of contamination is cause by other conditions such as mixed oil types or fuel contamination (there are other causes also). This loose-particle contamination is not the same as "black oil". If an oil sample is visually identified as black oil, do the procedures that follow to find the cause of the black oil condition.

(2) Procedures. See Figure 117.

F. Oil Fumes In The Aircraft Cabin

(1) General

(a) Fumes in the cabin can be the result of oil leaking into the compressor section of the main engines because of compressor bearing compartment damage. Oil fumes can then travel through the engine supplied bleed air to the cabin. Other sources for oil fumes in the cabin are the air cycle machine and the auxiliary power unit (APU).

(2) Procedures. See Figures 118 thru 122.

G. Oil Pressure Problems

(1) General

(a) Problems with engine oil pressure are caused by:

1 Supply (no oil in the tank, or not sufficient oil quantity to supply the oil pump)

2 Pressure system defects (damage to the main oil pump or to the pressure relief valve)

R
R

3 Defects in the powerplant/aircraft oil pressure indication system

4 Blockage of oil passages with unwanted material

5 Internal engine damage (broken oil jets, tubes, etc.)

(2) Fluctuating Oil Pressure

(a) There are inspection operations in the troubleshooting tables for defects in the oil system that can cause fluctuating oil pressure. These causes (and their solutions) are in the order in which they will probably occur. Black oil, oil which is not sufficient, or leaks in the oil system can cause fluctuating oil pressure. There can be a defect in the oil pressure indication system (for example the restrictor in the oil pressure indication line can be not in position). There can also be damage to the pressure relief valve which causes the internal parts to not move. It is possible that the main oil pump will have intermittent oil flow, or that there is blockage of the internal gearbox passages.

(3) Oil Pressure Follows The Power Lever

(a) Oil pressure "follows the power lever" when the oil pressure gets higher as the engine power increases. This occurs usually because the oil pressure relief valve does not operate correctly. The pressure relief valve has a bypass circuit which releases oil back to the pump when the pressure gets above the set limit. If this system has a failure, only power lever movement will control oil pressure.

1 One cause of this conditions can be blockage in the gearbox passage which has the bypass oil in it.

2 Another cause can be blockage of the oil pressure sense line from the fuel-oil cooler to the gearbox housing.

R
R

3 Another cause can be a pressure relief valve which does not operate correctly (because the internal parts will not move).

(b) The pressure relief valve has an internal piston with a spring load. Spring rate and breather pressure push this piston in the direction of decreased oil bypass flow. Oil pressure (downstream of the fuel-oil cooler) goes through a sense line to the opposite side of the valve piston. When this sense line pressure decreases, the valve piston lets less oil into the bypass circuit and more oil into the engine. If the passage for bypass oil in the gearbox is blocked, there will be no bypass oil flow; if the oil pressure sense line from the fuel-oil cooler to the gearbox is blocked, there will be no pressure on the internal spring to open the valve into the bypass passage. Blockage of either the sense line or the bypass passage will cause engine oil pressure to follow the engine power lever.

(4) Procedures

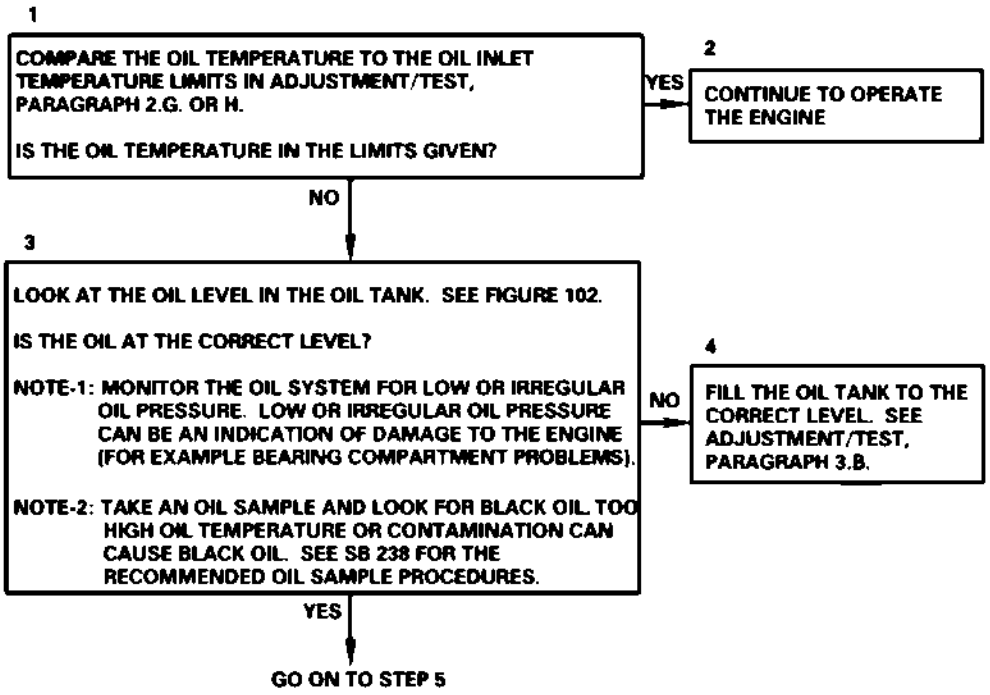
(a) Low Or No Oil Pressure See Figures 123 thru 125.

(b) Fluctuating Oil Pressure See Figure 126.

(c) Oil Pressure Follows The Power Lever See Figure 127.

(d) High Oil Pressure See Figure 128.

HIGH OIL TEMPERATURE


1
COMPARE THE OIL TEMPERATURE TO THE OIL INLET TEMPERATURE LIMITS IN ADJUSTMENT/TEST, PARAGRAPH 2.G. OR H.
IS THE OIL TEMPERATURE IN THE LIMITS GIVEN?
YES
2
CONTINUE TO OPERATE THE ENGINE
NO
3
LOOK AT THE OIL LEVEL IN THE OIL TANK. SEE FIGURE 102.
IS THE OIL AT THE CORRECT LEVEL?
NOTE-1: MONITOR THE OIL SYSTEM FOR LOW OR IRREGULAR OIL PRESSURE. LOW OR IRREGULAR OIL PRESSURE CAN BE AN INDICATION OF DAMAGE TO THE ENGINE (FOR EXAMPLE BEARING COMPARTMENT PROBLEMS).
NOTE-2: TAKE AN OIL SAMPLE AND LOOK FOR BLACK OIL. TOO HIGH OIL TEMPERATURE OR CONTAMINATION CAN CAUSE BLACK OIL. SEE SB 238 FOR THE RECOMMENDED OIL SAMPLE PROCEDURES.
NO
4
FILL THE OIL TANK TO THE CORRECT LEVEL. SEE ADJUSTMENT/TEST, PARAGRAPH 3.B.
YES
GO ON TO STEP 5

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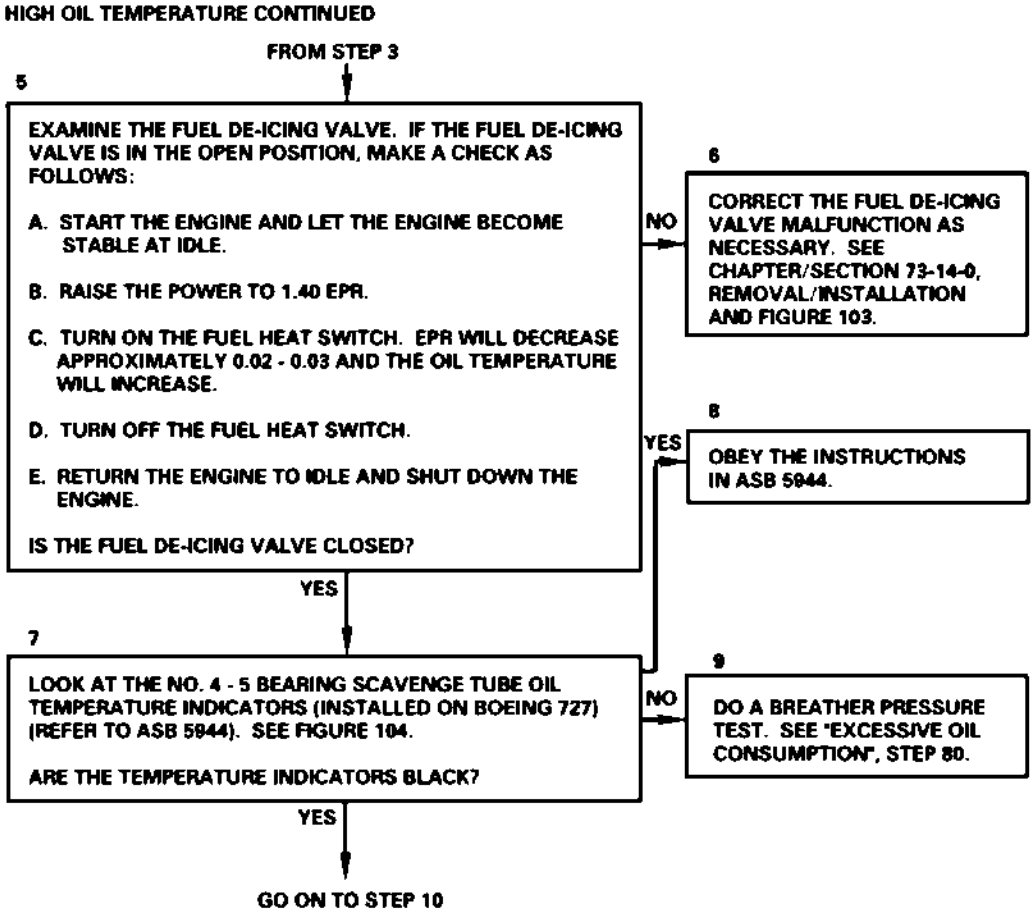
HIGH OIL TEMPERATURE CONTINUED
FROM STEP 3
5
EXAMINE THE FUEL DE-ICING VALVE. IF THE FUEL DE-ICING VALVE IS IN THE OPEN POSITION, MAKE A CHECK AS FOLLOWS:
A. START THE ENGINE AND LET THE ENGINE BECOME STABLE AT IDLE.
B. RAISE THE POWER TO 1.40 EPR.
C. TURN ON THE FUEL HEAT SWITCH. EPR WILL DECREASE APPROXIMATELY 0.02 - 0.03 AND THE OIL TEMPERATURE WILL INCREASE.
D. TURN OFF THE FUEL HEAT SWITCH.
E. RETURN THE ENGINE TO IDLE AND SHUT DOWN THE ENGINE.
IS THE FUEL DE-ICING VALVE CLOSED?
NO
6
CORRECT THE FUEL DE-ICING VALVE MALFUNCTION AS NECESSARY. SEE CHAPTER/SECTION 73-14-0, REMOVAL/INSTALLATION AND FIGURE 103.
YES
8
OBEY THE INSTRUCTIONS IN ASB 5944.
YES
7
LOOK AT THE NO. 4 - 5 BEARING SCAVENGE TUBE OIL TEMPERATURE INDICATORS (INSTALLED ON BOEING 727) (REFER TO ASB 5944). SEE FIGURE 104.
ARE THE TEMPERATURE INDICATORS BLACK?
NO
9
DO A BREATHER PRESSURE TEST. SEE "EXCESSIVE OIL CONSUMPTION", STEP 80.
YES
GO ON TO STEP 10

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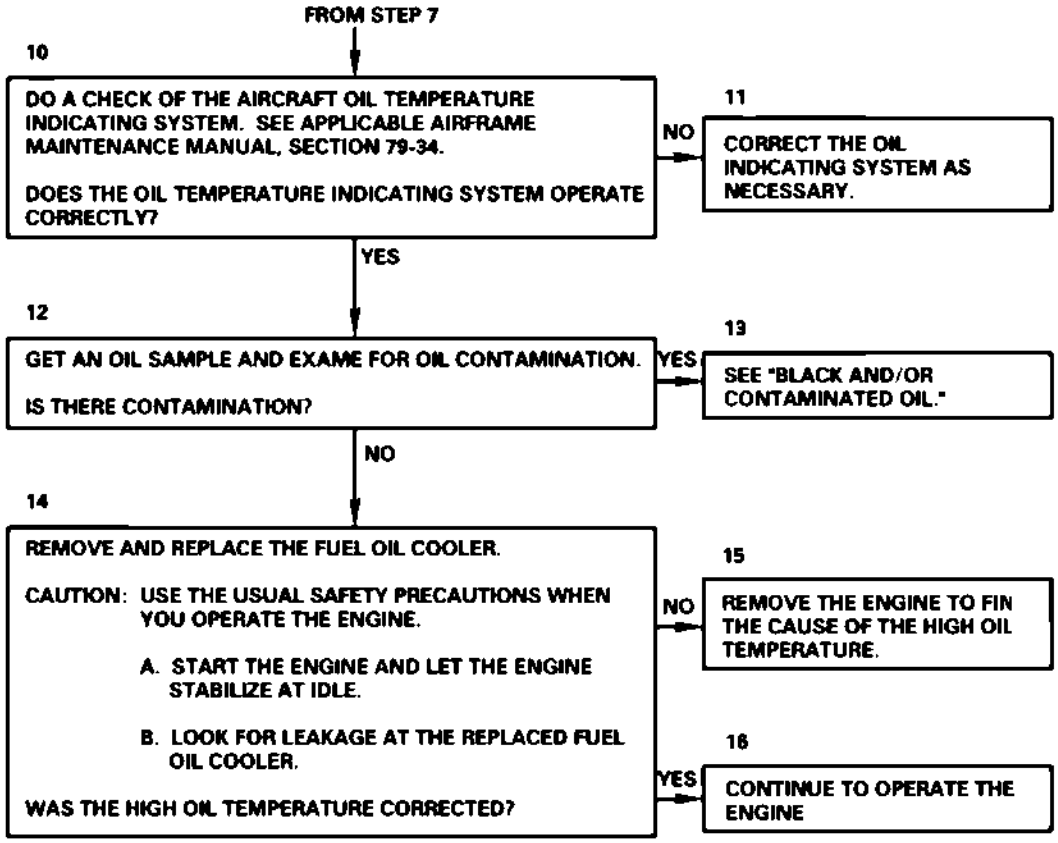
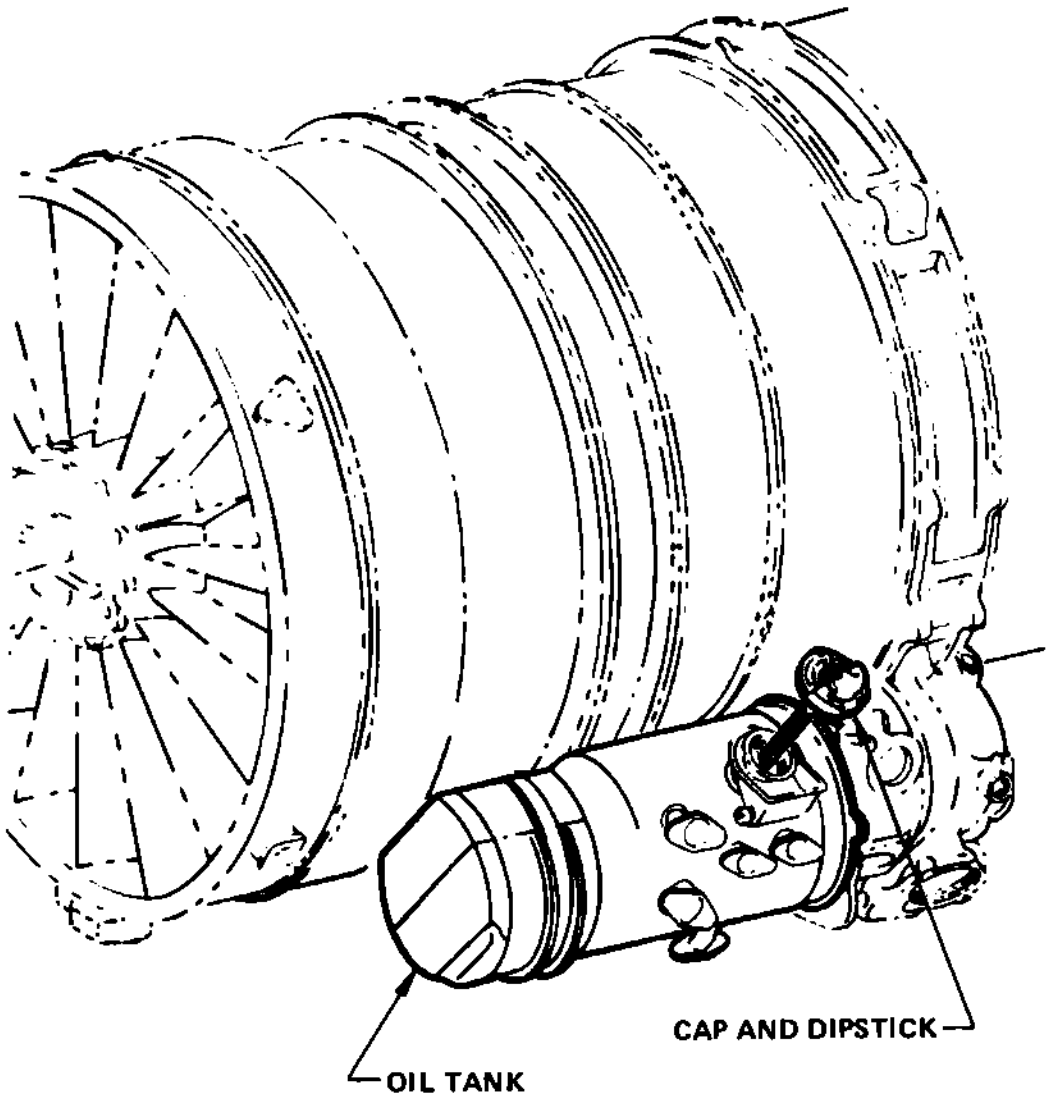
High Oil Temperature
Troubleshooting
Figure 101 (Sheet 2)
(Task 72-00-00-810-004)

HIGH OIL TEMPERATURE CONTINUED

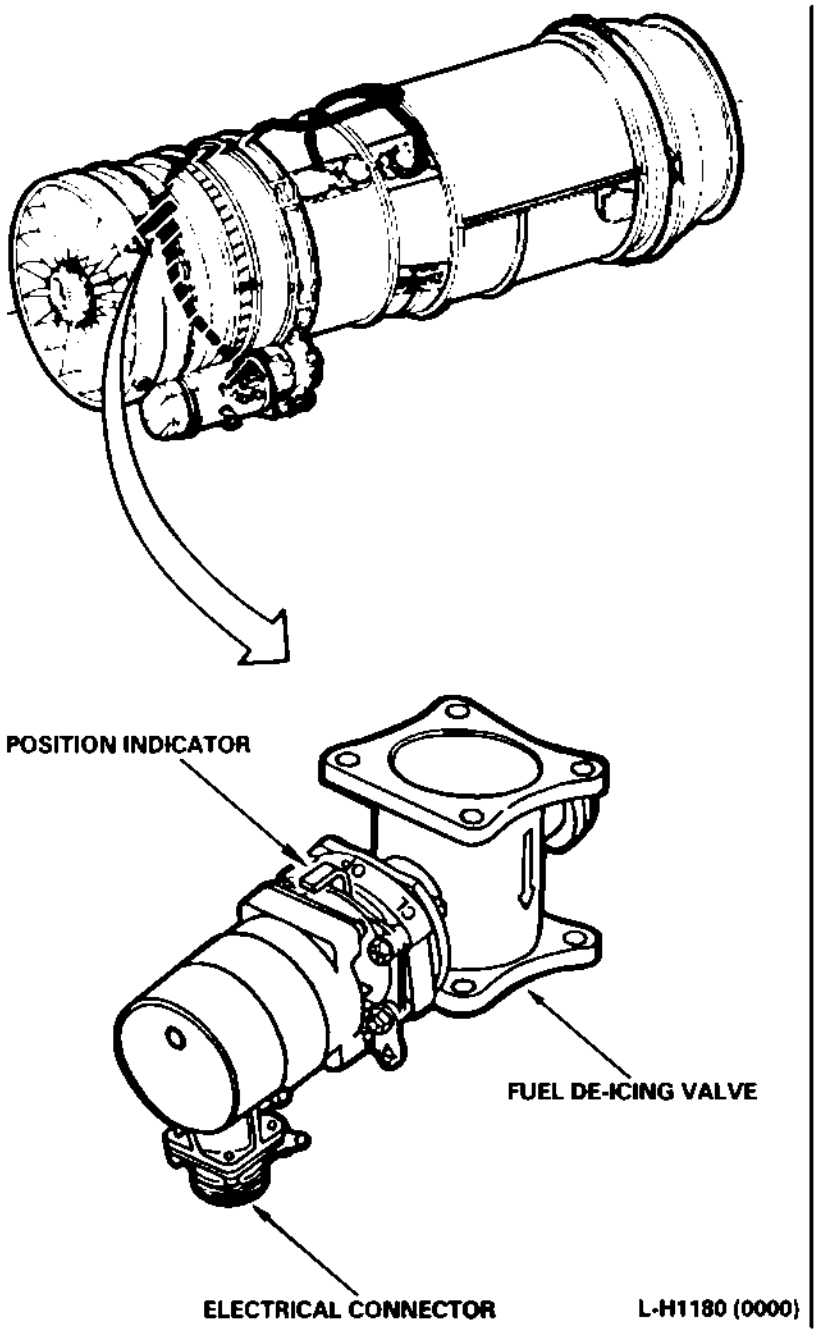

FROM STEP 7
10
DO A CHECK OF THE AIRCRAFT OIL TEMPERATURE INDICATING SYSTEM. SEE APPLICABLE AIRFRAME MAINTENANCE MANUAL, SECTION 79-34.
DOES THE OIL TEMPERATURE INDICATING SYSTEM OPERATE CORRECTLY?
NO
11
CORRECT THE OIL INDICATING SYSTEM AS NECESSARY.
YES
12
GET AN OIL SAMPLE AND EXAME FOR OIL CONTAMINATION.
IS THERE CONTAMINATION?
YES
13
SEE "BLACK AND/OR CONTAMINATED OIL."
NO
14
REMOVE AND REPLACE THE FUEL OIL COOLER.
CAUTION: USE THE USUAL SAFETY PRECAUTIONS WHEN YOU OPERATE THE ENGINE.
A. START THE ENGINE AND LET THE ENGINE STABILIZE AT IDLE.
B. LOOK FOR LEAKAGE AT THE REPLACED FUEL OIL COOLER.
WAS THE HIGH OIL TEMPERATURE CORRECTED?
NO
15
REMOVE THE ENGINE TO FIN THE CAUSE OF THE HIGH OIL TEMPERATURE.
YES
16
CONTINUE TO OPERATE THE ENGINE

L-H1184 (0000)

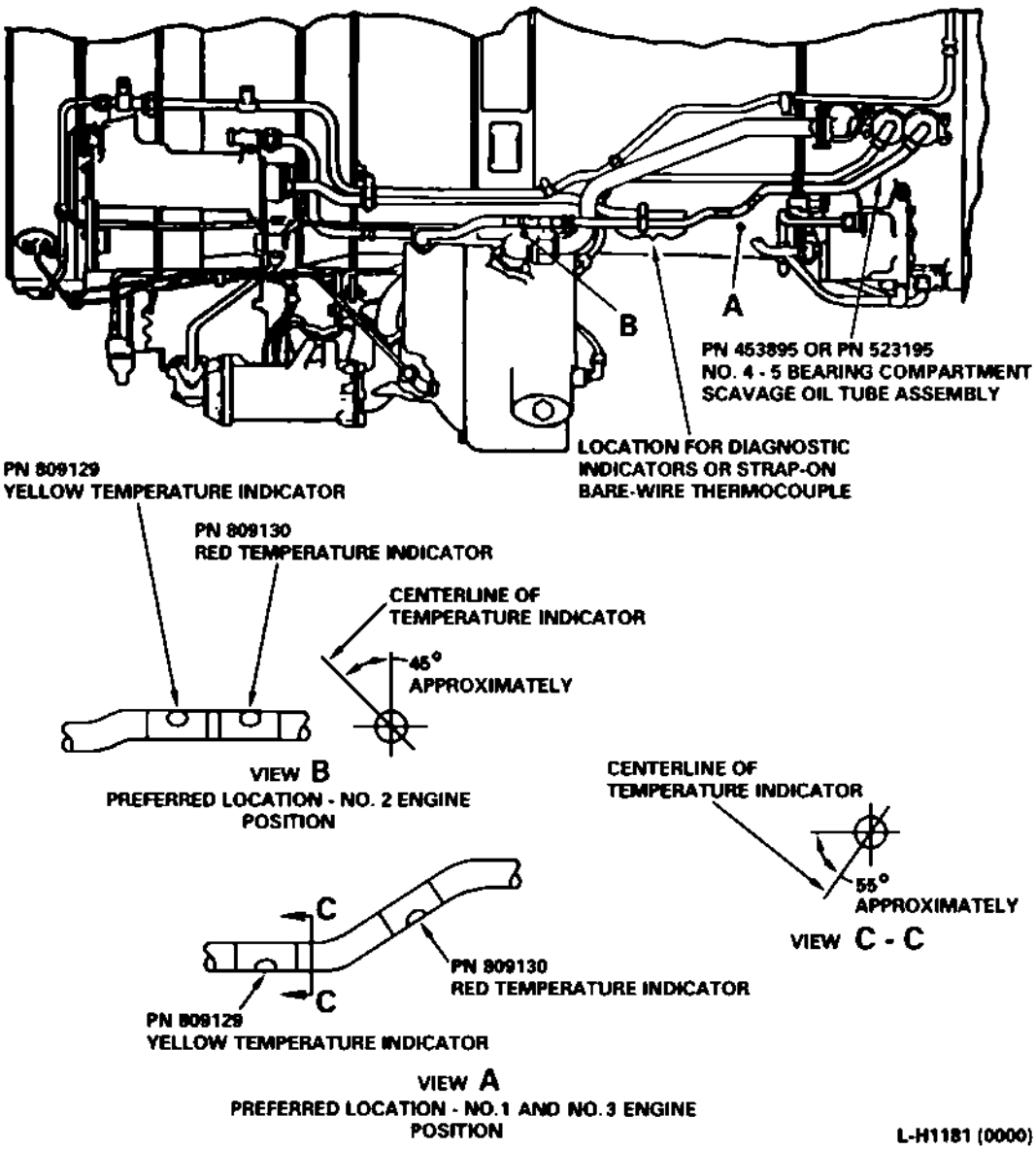
High Oil Temperature
Troubleshooting
Figure 101 (Sheet 3)
(Task 72-00-00-810-004)



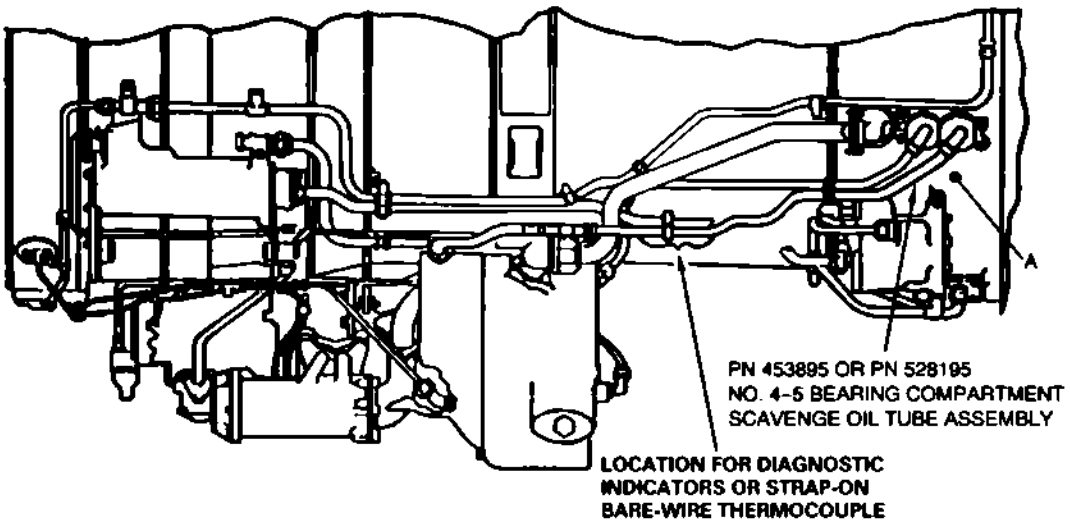
Oil Tank And Dip Stick
Figure 102
(Task 72-00-00-810-004)

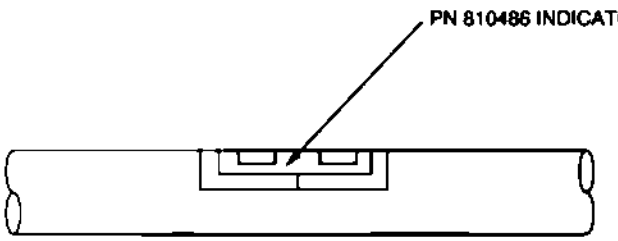


Fuel De-Icing Valve Check
Figure 103
(Task 72-00-00-810-004)



No. 4 And 5 Bearing Scavenge
Tube Oil Temperature
Indicators (ASB 5944)
Figure 104 (Sheet 1)
(Task 72-00-00-810-004)

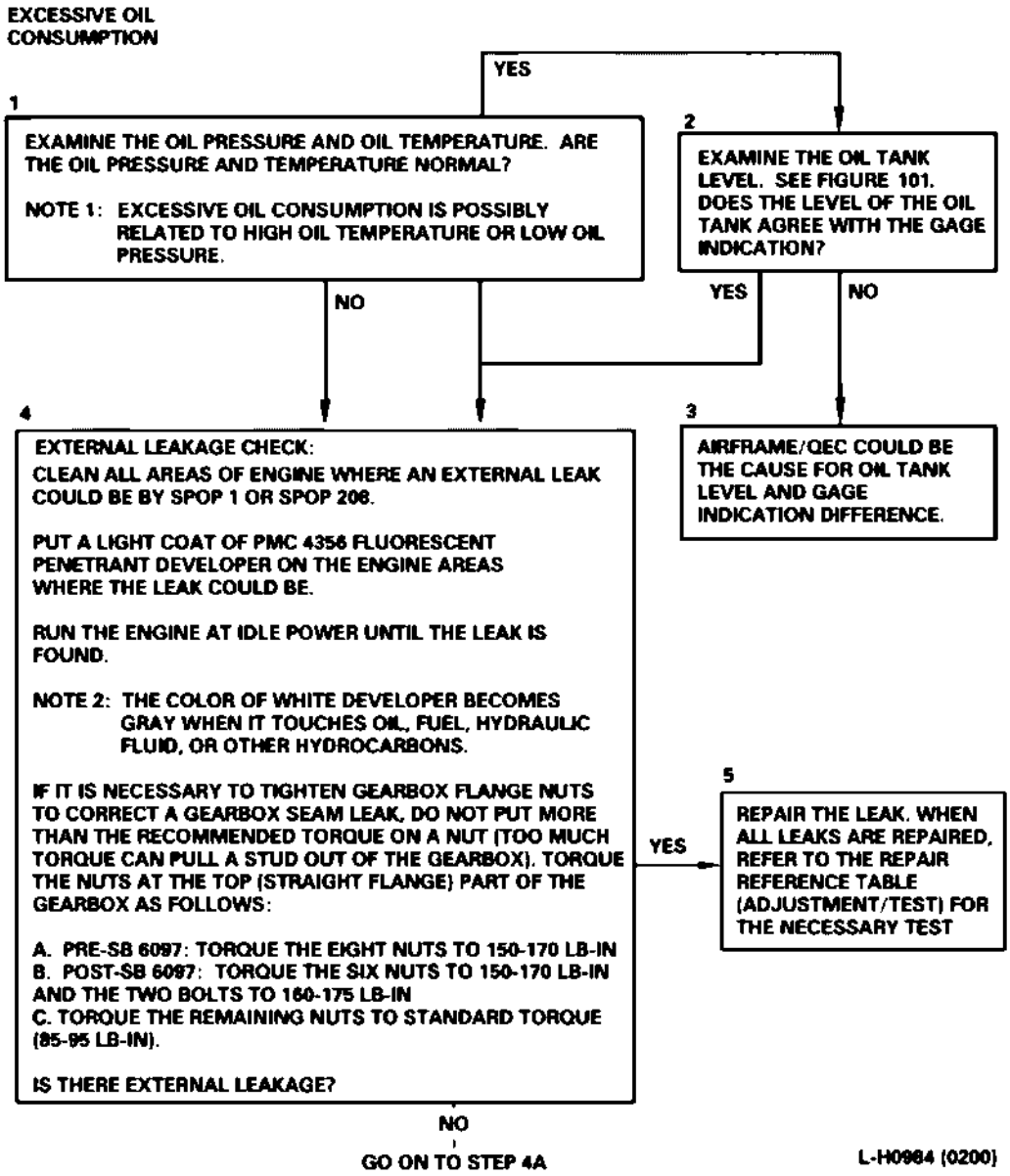




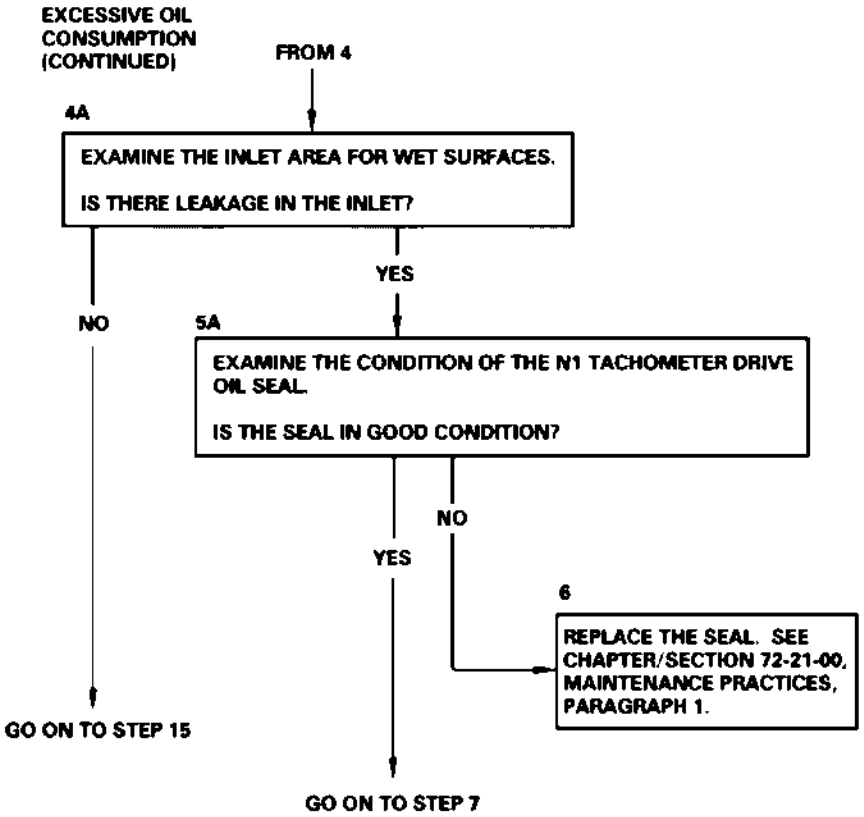
VIEW A

L-H3789 (0199)

No. 4 And 5 Bearing Scavenge
Tube Oil Temperature
Indicators (SB 6101)
Figure 104 (Sheet 2)
(Task 72-00-00-810-004)

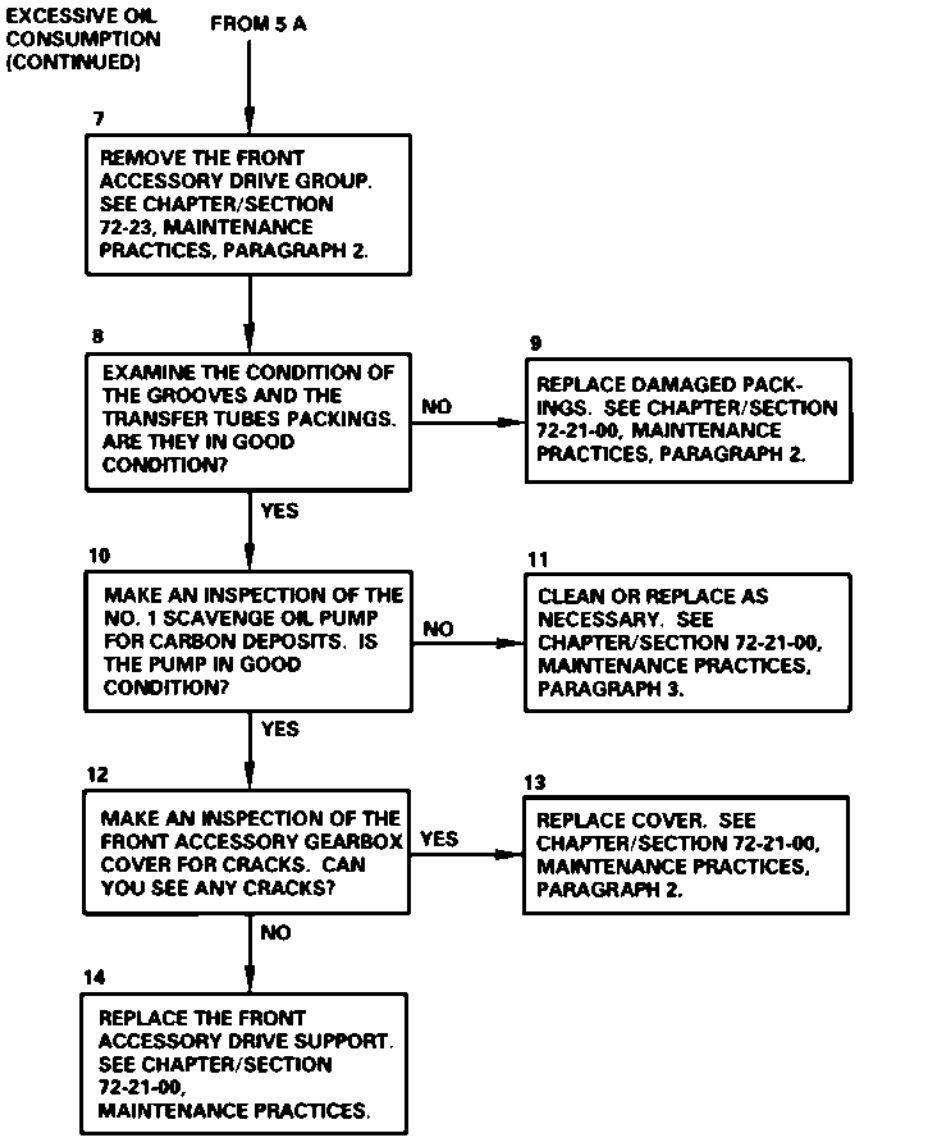

EXCESSIVE OIL CONSUMPTION
YES
1
EXAMINE THE OIL PRESSURE AND OIL TEMPERATURE. ARE THE OIL PRESSURE AND TEMPERATURE NORMAL?
NOTE 1: EXCESSIVE OIL CONSUMPTION IS POSSIBLY RELATED TO HIGH OIL TEMPERATURE OR LOW OIL PRESSURE.
2
EXAMINE THE OIL TANK LEVEL. SEE FIGURE 101. DOES THE LEVEL OF THE OIL TANK AGREE WITH THE GAGE INDICATION?
NO
YES
NO
4
EXTERNAL LEAKAGE CHECK:
CLEAN ALL AREAS OF ENGINE WHERE AN EXTERNAL LEAK COULD BE BY SPOP 1 OR SPOP 206.
PUT A LIGHT COAT OF PMC 4356 FLUORESCENT PENETRANT DEVELOPER ON THE ENGINE AREAS WHERE THE LEAK COULD BE.
RUN THE ENGINE AT IDLE POWER UNTIL THE LEAK IS FOUND.
NOTE 2: THE COLOR OF WHITE DEVELOPER BECOMES GRAY WHEN IT TOUCHES OIL, FUEL, HYDRAULIC FLUID, OR OTHER HYDROCARBONS.
IF IT IS NECESSARY TO TIGHTEN GEARBOX FLANGE NUTS TO CORRECT A GEARBOX SEAM LEAK, DO NOT PUT MORE THAN THE RECOMMENDED TORQUE ON A NUT (TOO MUCH TORQUE CAN PULL A STUD OUT OF THE GEARBOX). TORQUE THE NUTS AT THE TOP (STRAIGHT FLANGE) PART OF THE GEARBOX AS FOLLOWS:
A. PRE-SB 6097: TORQUE THE EIGHT NUTS TO 150-170 LB-IN
B. POST-SB 6097: TORQUE THE SIX NUTS TO 150-170 LB-IN AND THE TWO BOLTS TO 160-175 LB-IN
C. TORQUE THE REMAINING NUTS TO STANDARD TORQUE (85-95 LB-IN).
IS THERE EXTERNAL LEAKAGE?
3
AIRFRAME/QEC COULD BE THE CAUSE FOR OIL TANK LEVEL AND GAGE INDICATION DIFFERENCE.
YES
5
REPAIR THE LEAK. WHEN ALL LEAKS ARE REPAIRED, REFER TO THE REPAIR REFERENCE TABLE (ADJUSTMENT/TEST) FOR THE NECESSARY TEST
NO
GO ON TO STEP 4A
L-H0984 (0200)

Excessive Oil Consumption
Troubleshooting
Figure 105 (Sheet 1)
(Task 72-00-00-810-004)

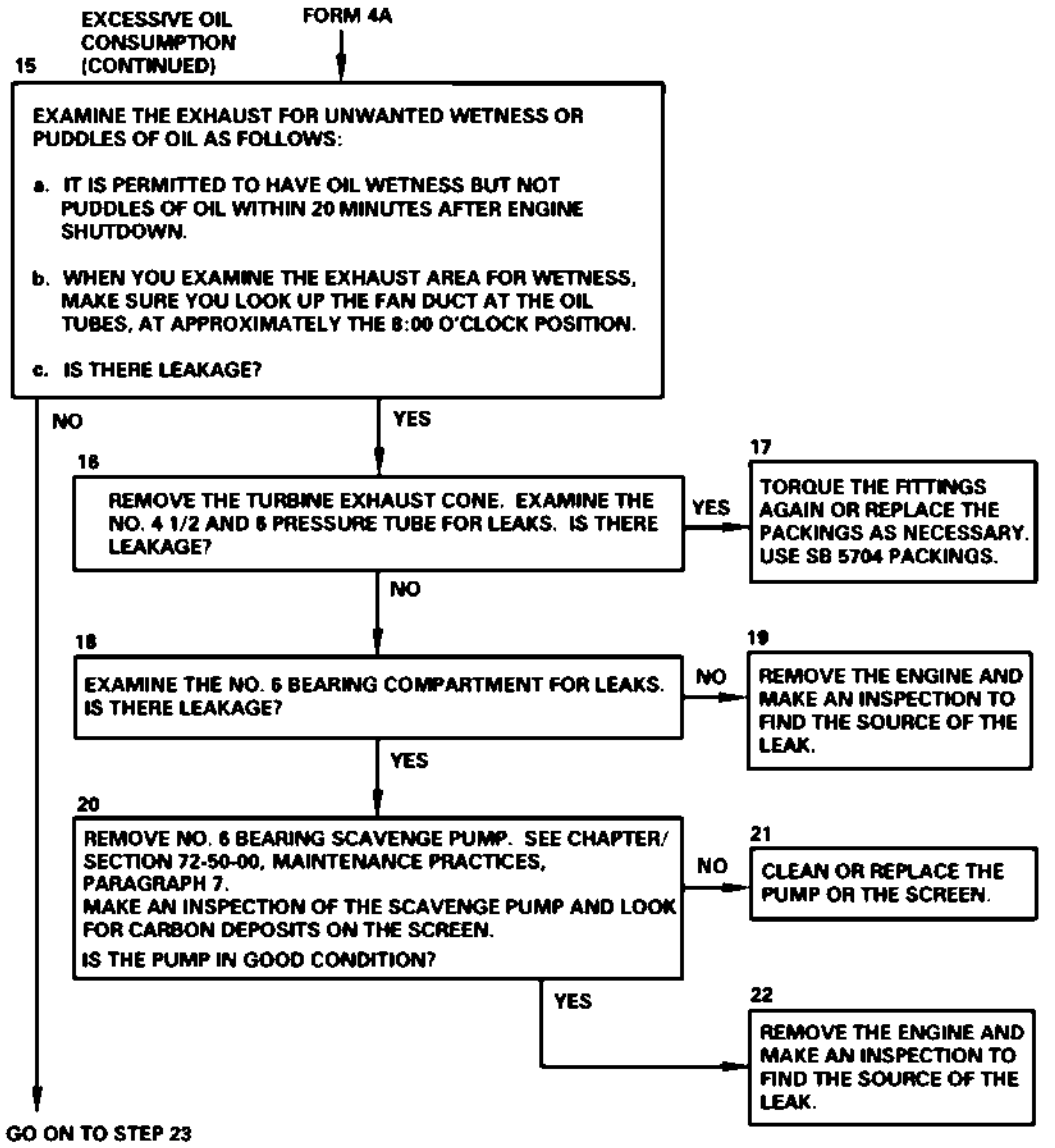


L-H4059 (0102)

Excessive Oil Consumption
Troubleshooting
Figure 105 (Sheet 2)
(Task 72-00-00-810-004)

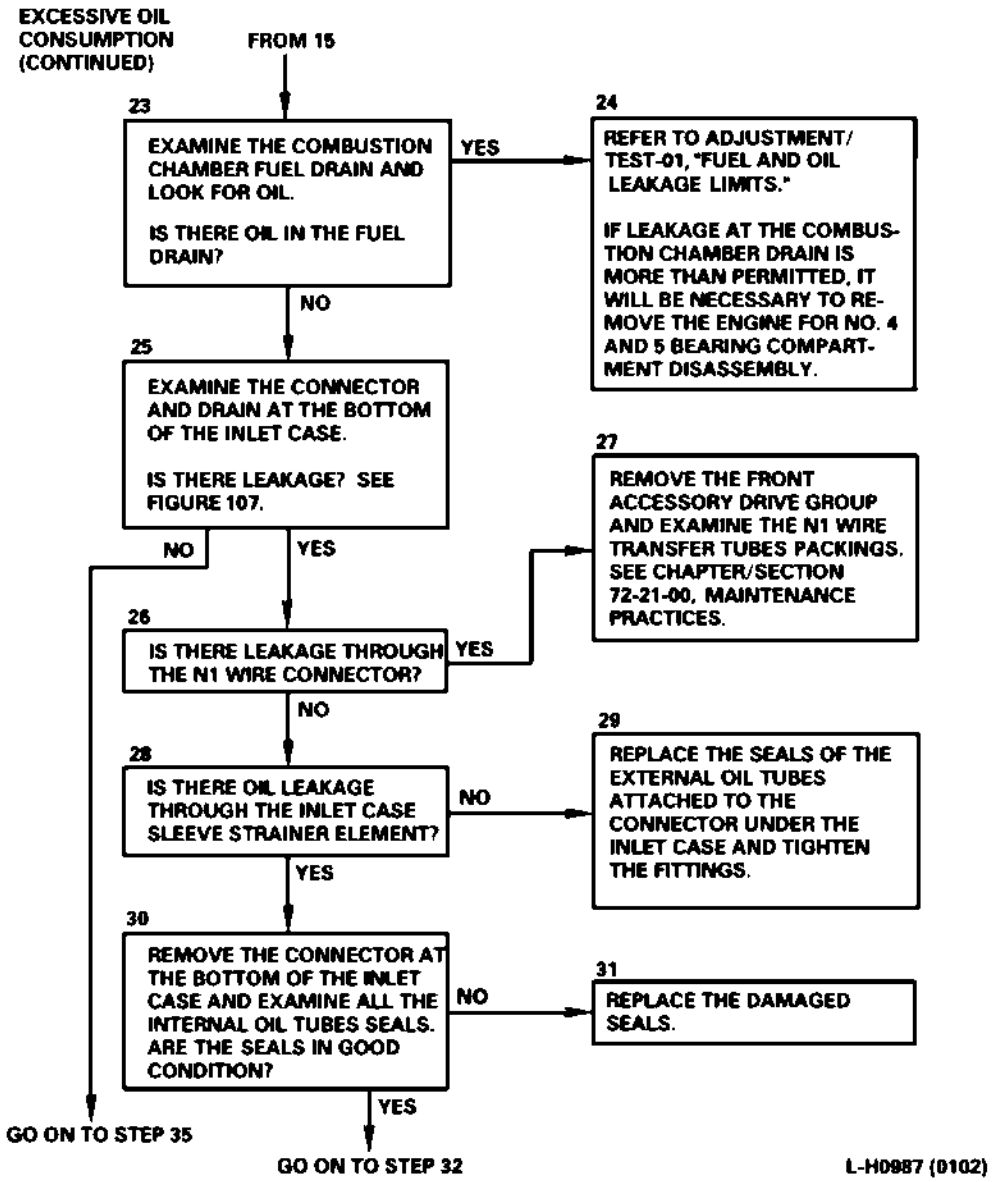

EXCESSIVE OIL CONSUMPTION (CONTINUED)
FROM 5 A
7
REMOVE THE FRONT ACCESSORY DRIVE GROUP. SEE CHAPTER/SECTION 72-23, MAINTENANCE PRACTICES, PARAGRAPH 2.
8
EXAMINE THE CONDITION OF THE GROOVES AND THE TRANSFER TUBES PACKINGS. ARE THEY IN GOOD CONDITION?
NO
9
REPLACE DAMAGED PACKINGS. SEE CHAPTER/SECTION 72-21-00, MAINTENANCE PRACTICES, PARAGRAPH 2.
YES
10
MAKE AN INSPECTION OF THE NO. 1 SCAVENGE OIL PUMP FOR CARBON DEPOSITS. IS THE PUMP IN GOOD CONDITION?
NO
11
CLEAN OR REPLACE AS NECESSARY. SEE CHAPTER/SECTION 72-21-00, MAINTENANCE PRACTICES, PARAGRAPH 3.
YES
12
MAKE AN INSPECTION OF THE FRONT ACCESSORY GEARBOX COVER FOR CRACKS. CAN YOU SEE ANY CRACKS?
YES
13
REPLACE COVER. SEE CHAPTER/SECTION 72-21-00, MAINTENANCE PRACTICES, PARAGRAPH 2.
NO
14
REPLACE THE FRONT ACCESSORY DRIVE SUPPORT. SEE CHAPTER/SECTION 72-21-00, MAINTENANCE PRACTICES.
L-H0985 (0102)

Excessive Oil Consumption
Troubleshooting
Figure 105 (Sheet 3)
(Task 72-00-00-810-004)

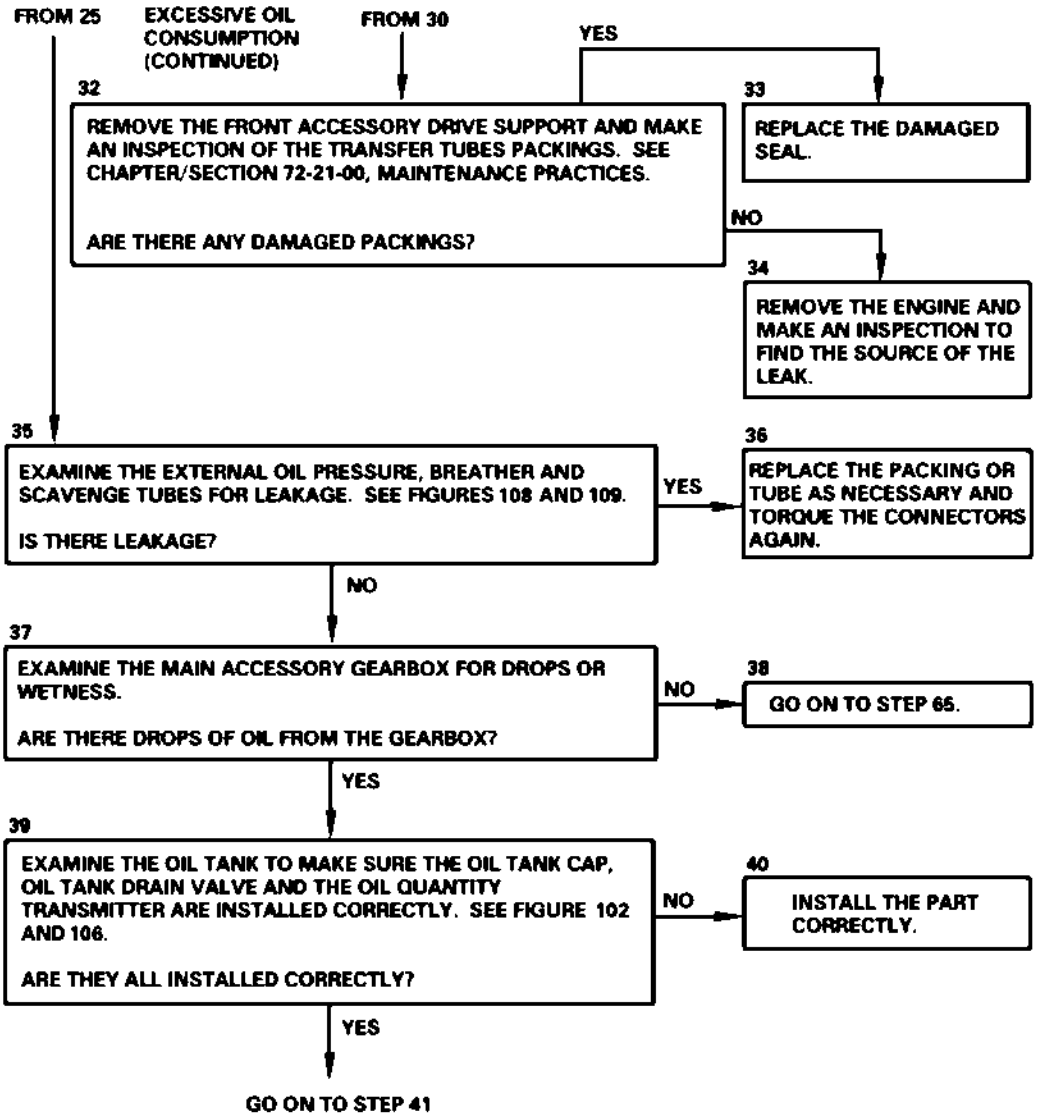

EXCESSIVE OIL CONSUMPTION (CONTINUED)
FORM 4A
15
EXAMINE THE EXHAUST FOR UNWANTED WETNESS OR PUDDLES OF OIL AS FOLLOWS:
a. IT IS PERMITTED TO HAVE OIL WETNESS BUT NOT PUDDLES OF OIL WITHIN 20 MINUTES AFTER ENGINE SHUTDOWN.
b. WHEN YOU EXAMINE THE EXHAUST AREA FOR WETNESS, MAKE SURE YOU LOOK UP THE FAN DUCT AT THE OIL TUBES, AT APPROXIMATELY THE 8:00 O'CLOCK POSITION.
c. IS THERE LEAKAGE?
NO
YES
16
REMOVE THE TURBINE EXHAUST CONE. EXAMINE THE NO. 4 1/2 AND 5 PRESSURE TUBE FOR LEAKS. IS THERE LEAKAGE?
YES
17
TORQUE THE FITTINGS AGAIN OR REPLACE THE PACKINGS AS NECESSARY. USE SB 5704 PACKINGS.
NO
18
EXAMINE THE NO. 6 BEARING COMPARTMENT FOR LEAKS. IS THERE LEAKAGE?
NO
19
REMOVE THE ENGINE AND MAKE AN INSPECTION TO FIND THE SOURCE OF THE LEAK.
YES
20
REMOVE NO. 6 BEARING SCAVENGE PUMP. SEE CHAPTER/SECTION 72-50-00, MAINTENANCE PRACTICES, PARAGRAPH 7.
MAKE AN INSPECTION OF THE SCAVENGE PUMP AND LOOK FOR CARBON DEPOSITS ON THE SCREEN.
IS THE PUMP IN GOOD CONDITION?
NO
21
CLEAN OR REPLACE THE PUMP OR THE SCREEN.
YES
22
REMOVE THE ENGINE AND MAKE AN INSPECTION TO FIND THE SOURCE OF THE LEAK.
GO ON TO STEP 23

L-H0988 (0102)

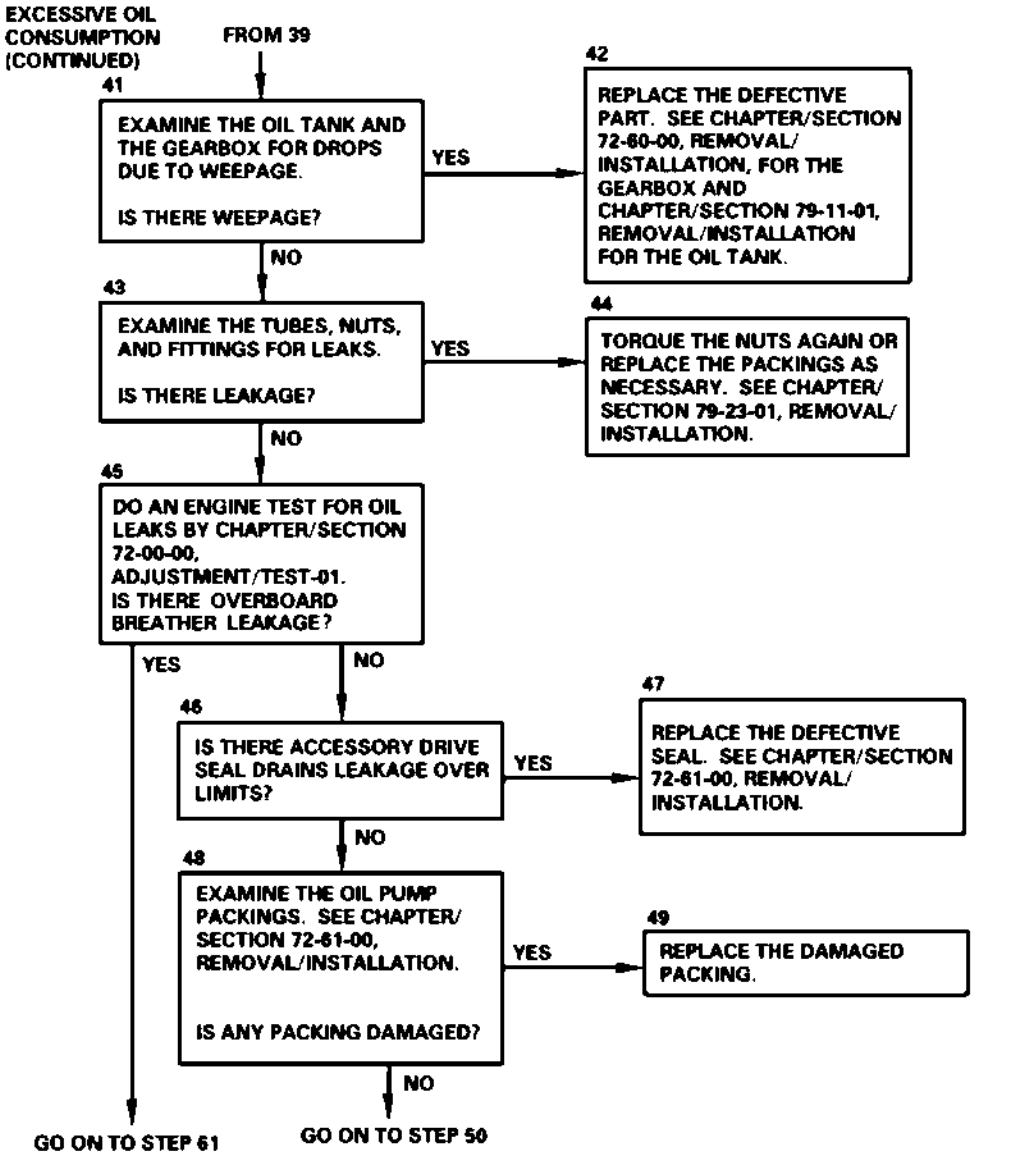
Excessive Oil Consumption
Troubleshooting
Figure 105 (Sheet 4)
(Task 72-00-00-810-004)


EXCESSIVE OIL CONSUMPTION (CONTINUED)
FROM 15
23
EXAMINE THE COMBUSTION CHAMBER FUEL DRAIN AND LOOK FOR OIL.
IS THERE OIL IN THE FUEL DRAIN?
YES
24
REFER TO ADJUSTMENT/ TEST-01, "FUEL AND OIL LEAKAGE LIMITS."
IF LEAKAGE AT THE COMBUSTION CHAMBER DRAIN IS MORE THAN PERMITTED, IT WILL BE NECESSARY TO REMOVE THE ENGINE FOR NO. 4 AND 5 BEARING COMPARTMENT DISASSEMBLY.
NO
25
EXAMINE THE CONNECTOR AND DRAIN AT THE BOTTOM OF THE INLET CASE.
IS THERE LEAKAGE? SEE FIGURE 107.
NO
YES
27
REMOVE THE FRONT ACCESSORY DRIVE GROUP AND EXAMINE THE N1 WIRE TRANSFER TUBES PACKINGS. SEE CHAPTER/SECTION 72-21-00, MAINTENANCE PRACTICES.
26
IS THERE LEAKAGE THROUGH THE N1 WIRE CONNECTOR?
YES
NO
29
REPLACE THE SEALS OF THE EXTERNAL OIL TUBES ATTACHED TO THE CONNECTOR UNDER THE INLET CASE AND TIGHTEN THE FITTINGS.
28
IS THERE OIL LEAKAGE THROUGH THE INLET CASE SLEEVE STRAINER ELEMENT?
NO
YES
30
REMOVE THE CONNECTOR AT THE BOTTOM OF THE INLET CASE AND EXAMINE ALL THE INTERNAL OIL TUBES SEALS. ARE THE SEALS IN GOOD CONDITION?
NO
31
REPLACE THE DAMAGED SEALS.
YES
GO ON TO STEP 35
GO ON TO STEP 32
L-H0987 (0102)

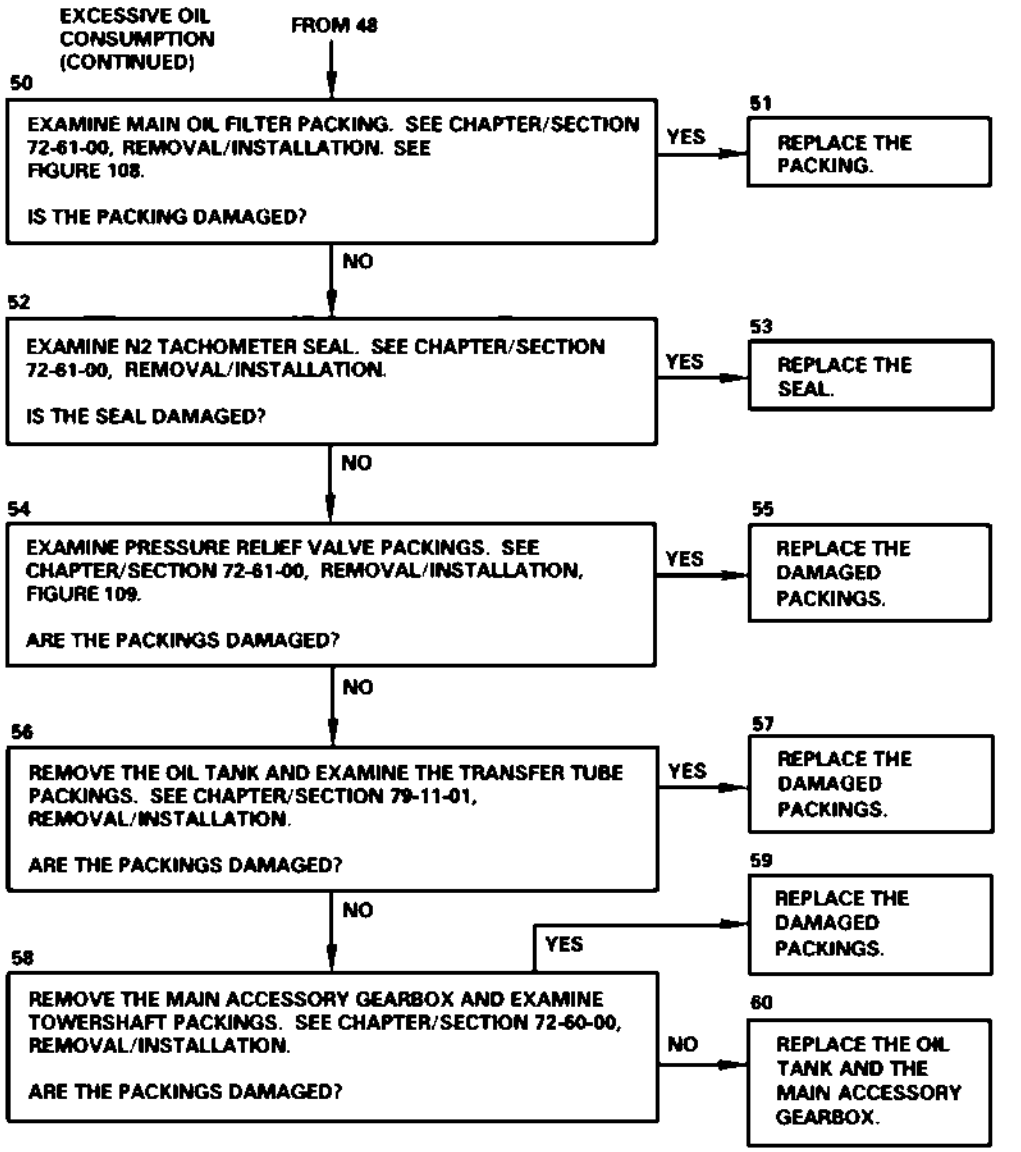
Excessive Oil Consumption
Troubleshooting
Figure 105 (Sheet 5)
(Task 72-00-00-810-004)


FROM 25
EXCESSIVE OIL CONSUMPTION (CONTINUED)
FROM 30
YES
32
REMOVE THE FRONT ACCESSORY DRIVE SUPPORT AND MAKE AN INSPECTION OF THE TRANSFER TUBES PACKINGS. SEE CHAPTER/SECTION 72-21-00, MAINTENANCE PRACTICES.
ARE THERE ANY DAMAGED PACKINGS?
33
REPLACE THE DAMAGED SEAL.
NO
34
REMOVE THE ENGINE AND MAKE AN INSPECTION TO FIND THE SOURCE OF THE LEAK.
35
EXAMINE THE EXTERNAL OIL PRESSURE, BREATHER AND SCAVENGE TUBES FOR LEAKAGE. SEE FIGURES 108 AND 109.
IS THERE LEAKAGE?
YES
36
REPLACE THE PACKING OR TUBE AS NECESSARY AND TORQUE THE CONNECTORS AGAIN.
NO
37
EXAMINE THE MAIN ACCESSORY GEARBOX FOR DROPS OR WETNESS.
ARE THERE DROPS OF OIL FROM THE GEARBOX?
NO
38
GO ON TO STEP 65.
YES
39
EXAMINE THE OIL TANK TO MAKE SURE THE OIL TANK CAP, OIL TANK DRAIN VALVE AND THE OIL QUANTITY TRANSMITTER ARE INSTALLED CORRECTLY. SEE FIGURE 102 AND 106.
ARE THEY ALL INSTALLED CORRECTLY?
NO
40
INSTALL THE PART CORRECTLY.
YES
GO ON TO STEP 41
L-H0988 (0102)

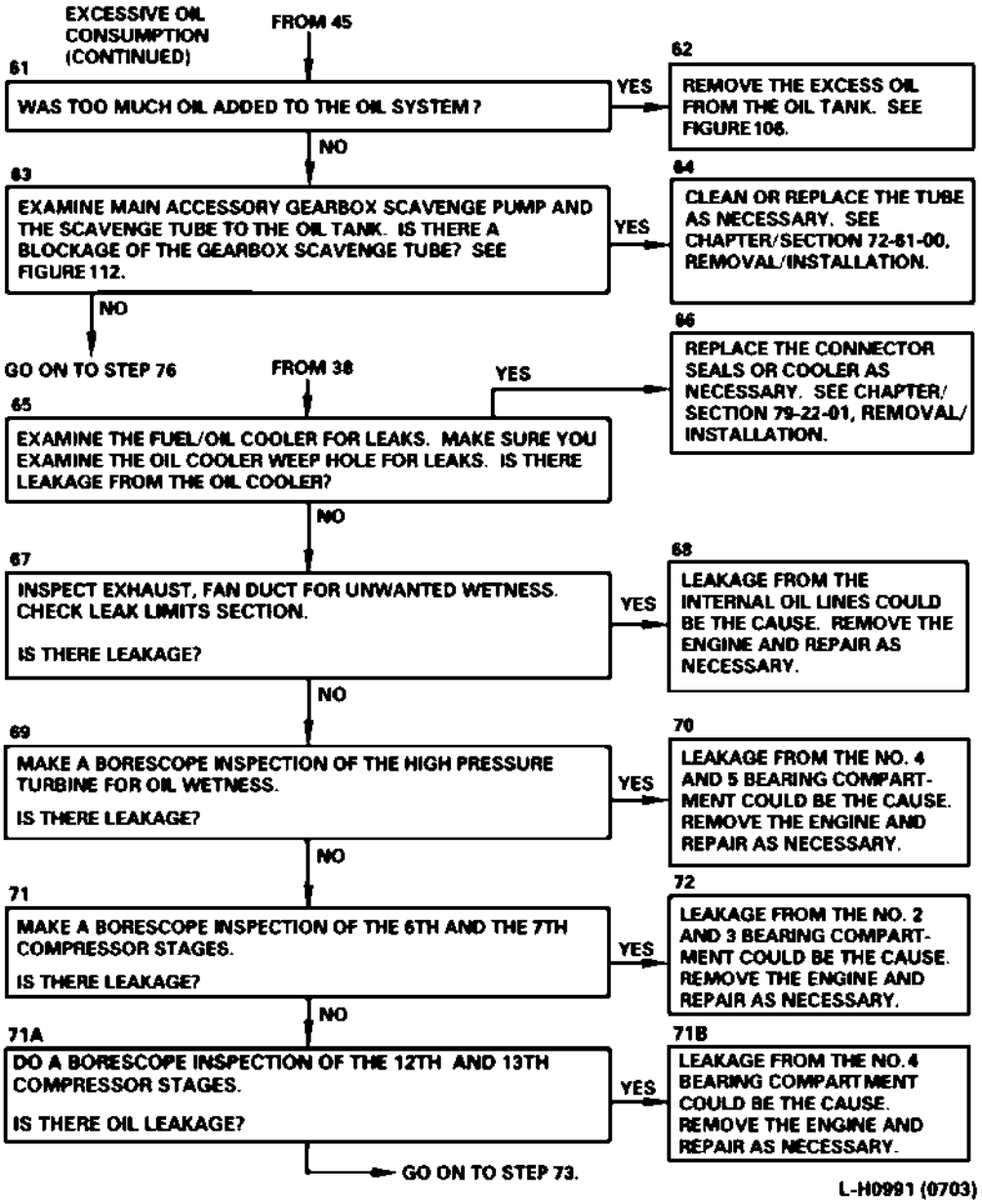
Excessive Oil Consumption
Troubleshooting
Figure 105 (Sheet 6)
(Task 72-00-00-810-004)


EXCESSIVE OIL CONSUMPTION (CONTINUED)
FROM 39
41
EXAMINE THE OIL TANK AND THE GEARBOX FOR DROPS DUE TO WEEPAGE.
IS THERE WEEPAGE?
YES
42
REPLACE THE DEFECTIVE PART. SEE CHAPTER/SECTION 72-60-00, REMOVAL/ INSTALLATION, FOR THE GEARBOX AND CHAPTER/SECTION 79-11-01, REMOVAL/INSTALLATION FOR THE OIL TANK.
NO
43
EXAMINE THE TUBES, NUTS, AND FITTINGS FOR LEAKS.
IS THERE LEAKAGE?
YES
44
TORQUE THE NUTS AGAIN OR REPLACE THE PACKINGS AS NECESSARY. SEE CHAPTER/ SECTION 79-23-01, REMOVAL/ INSTALLATION.
NO
45
DO AN ENGINE TEST FOR OIL LEAKS BY CHAPTER/SECTION 72-00-00, ADJUSTMENT/TEST-01.
IS THERE OVERBOARD BREATHER LEAKAGE?
YES
NO
46
IS THERE ACCESSORY DRIVE SEAL DRAINS LEAKAGE OVER LIMITS?
YES
47
REPLACE THE DEFECTIVE SEAL. SEE CHAPTER/SECTION 72-61-00, REMOVAL/ INSTALLATION.
NO
48
EXAMINE THE OIL PUMP PACKINGS. SEE CHAPTER/ SECTION 72-61-00, REMOVAL/INSTALLATION.
IS ANY PACKING DAMAGED?
YES
49
REPLACE THE DAMAGED PACKING.
NO
GO ON TO STEP 61
GO ON TO STEP 50
L-H0989 (0102)

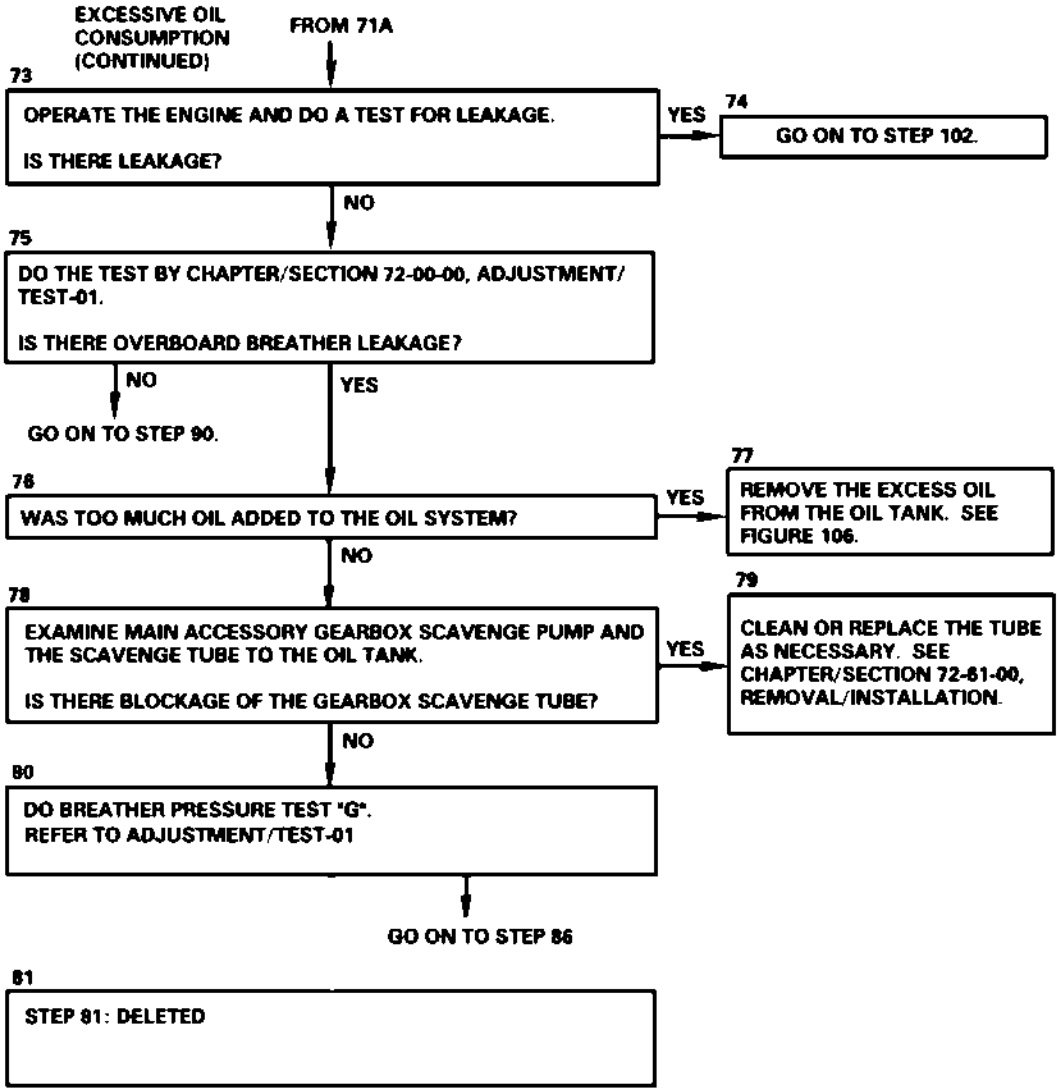
Excessive Oil Consumption
Troubleshooting
Figure 105 (Sheet 7)
(Task 72-00-00-810-004)



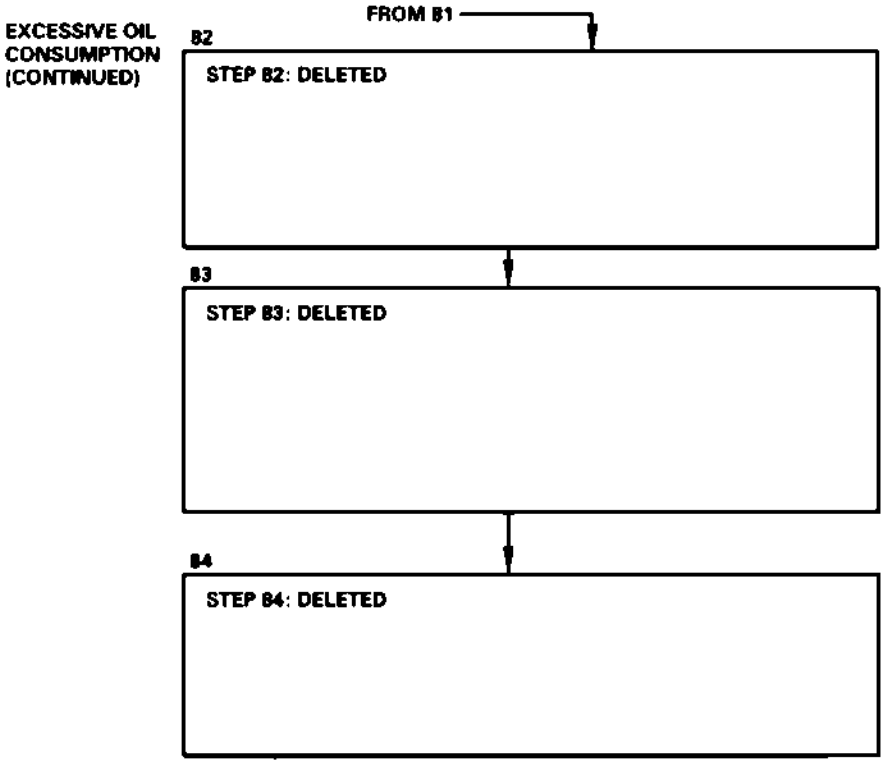
Excessive Oil Consumption
Troubleshooting
Figure 105 (Sheet 8)
(Task 72-00-00-810-004)


EXCESSIVE OIL CONSUMPTION (CONTINUED)
FROM 45
61
WAS TOO MUCH OIL ADDED TO THE OIL SYSTEM?
YES
62
REMOVE THE EXCESS OIL FROM THE OIL TANK. SEE FIGURE 106.
NO
63
EXAMINE MAIN ACCESSORY GEARBOX SCAVENGE PUMP AND THE SCAVENGE TUBE TO THE OIL TANK. IS THERE A BLOCKAGE OF THE GEARBOX SCAVENGE TUBE? SEE FIGURE 112.
YES
64
CLEAN OR REPLACE THE TUBE AS NECESSARY. SEE CHAPTER/SECTION 72-61-00, REMOVAL/INSTALLATION.
NO
GO ON TO STEP 76
FROM 38
YES
66
REPLACE THE CONNECTOR SEALS OR COOLER AS NECESSARY. SEE CHAPTER/SECTION 79-22-01, REMOVAL/INSTALLATION.
65
EXAMINE THE FUEL/OIL COOLER FOR LEAKS. MAKE SURE YOU EXAMINE THE OIL COOLER WEEP HOLE FOR LEAKS. IS THERE LEAKAGE FROM THE OIL COOLER?
NO
67
INSPECT EXHAUST, FAN DUCT FOR UNWANTED WETNESS. CHECK LEAK LIMITS SECTION.
IS THERE LEAKAGE?
YES
68
LEAKAGE FROM THE INTERNAL OIL LINES COULD BE THE CAUSE. REMOVE THE ENGINE AND REPAIR AS NECESSARY.
NO
69
MAKE A BORESCOPE INSPECTION OF THE HIGH PRESSURE TURBINE FOR OIL WETNESS.
IS THERE LEAKAGE?
YES
70
LEAKAGE FROM THE NO. 4 AND 5 BEARING COMPARTMENT COULD BE THE CAUSE. REMOVE THE ENGINE AND REPAIR AS NECESSARY.
NO
71
MAKE A BORESCOPE INSPECTION OF THE 6TH AND THE 7TH COMPRESSOR STAGES.
IS THERE LEAKAGE?
YES
72
LEAKAGE FROM THE NO. 2 AND 3 BEARING COMPARTMENT COULD BE THE CAUSE. REMOVE THE ENGINE AND REPAIR AS NECESSARY.
NO
71A
DO A BORESCOPE INSPECTION OF THE 12TH AND 13TH COMPRESSOR STAGES.
IS THERE OIL LEAKAGE?
YES
71B
LEAKAGE FROM THE NO. 4 BEARING COMPARTMENT COULD BE THE CAUSE. REMOVE THE ENGINE AND REPAIR AS NECESSARY.
GO ON TO STEP 73.
L-H0991 (0703)

Excessive Oil Consumption
Troubleshooting
Figure 105 (Sheet 9)
(Task 72-00-00-810-004)

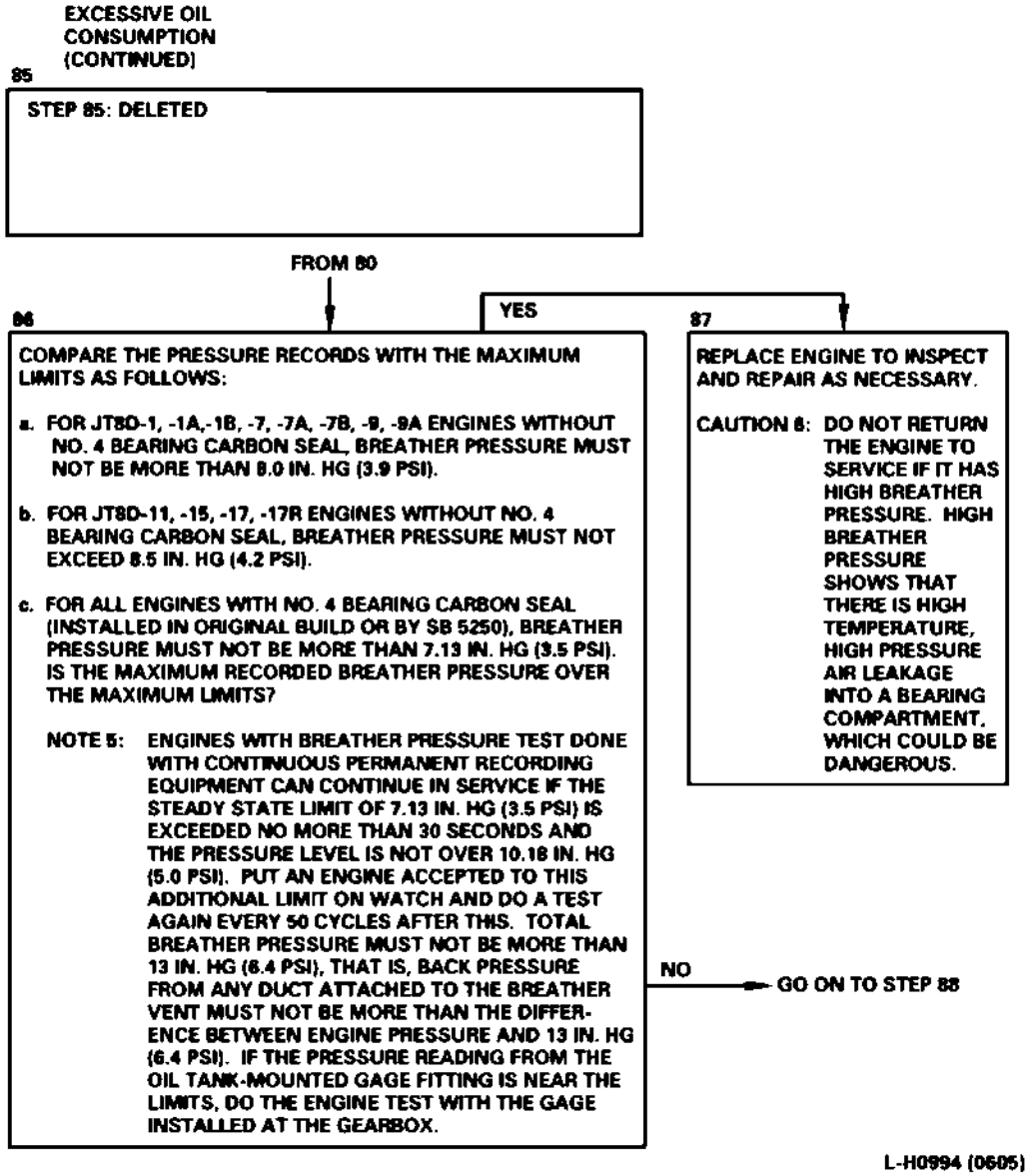


Excessive Oil Consumption
Troubleshooting
Figure 105 (Sheet 10)
(Task 72-00-00-810-004)

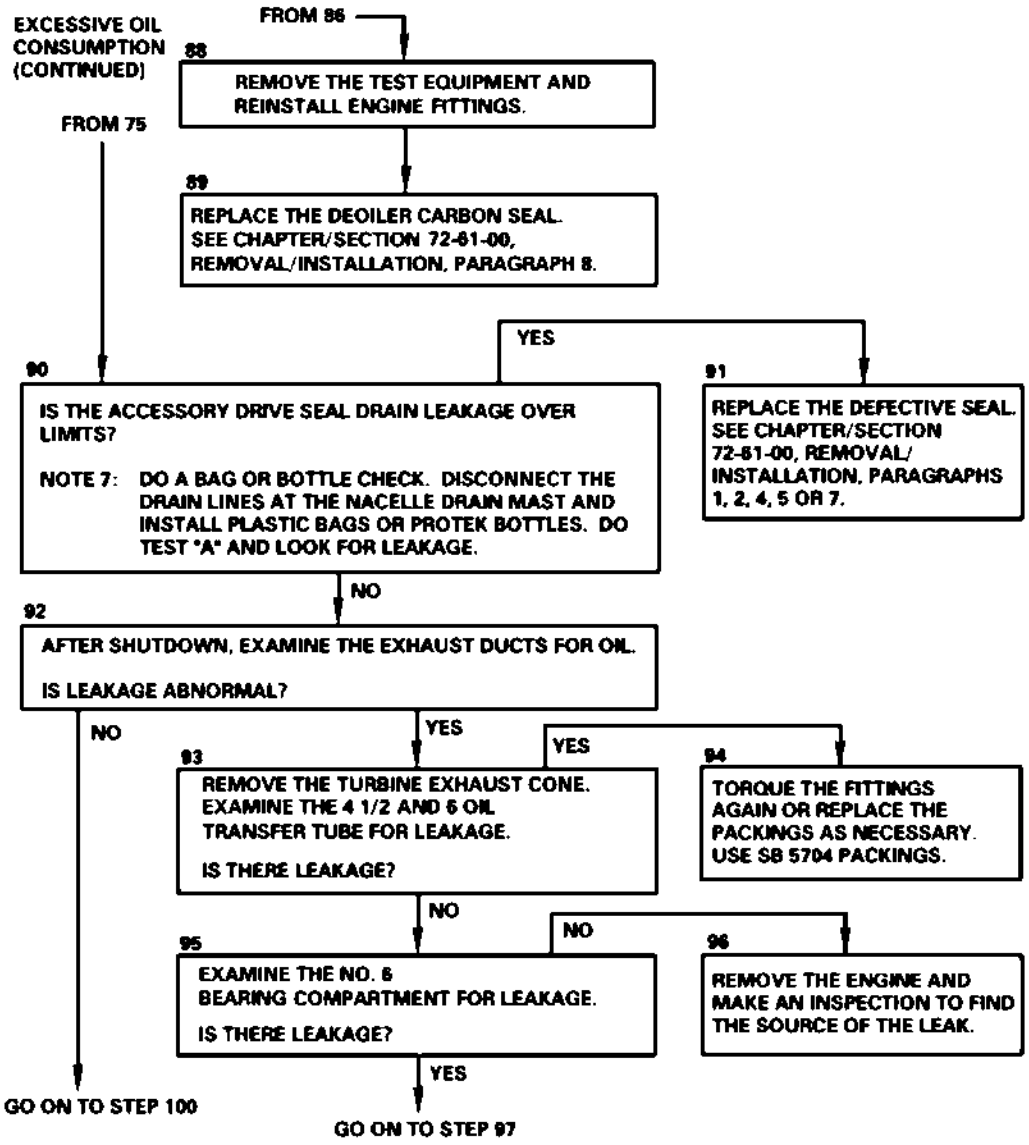


L-H0993 (0605)

Excessive Oil Consumption
Troubleshooting
Figure 105 (Sheet 11)
(Task 72-00-00-810-004)

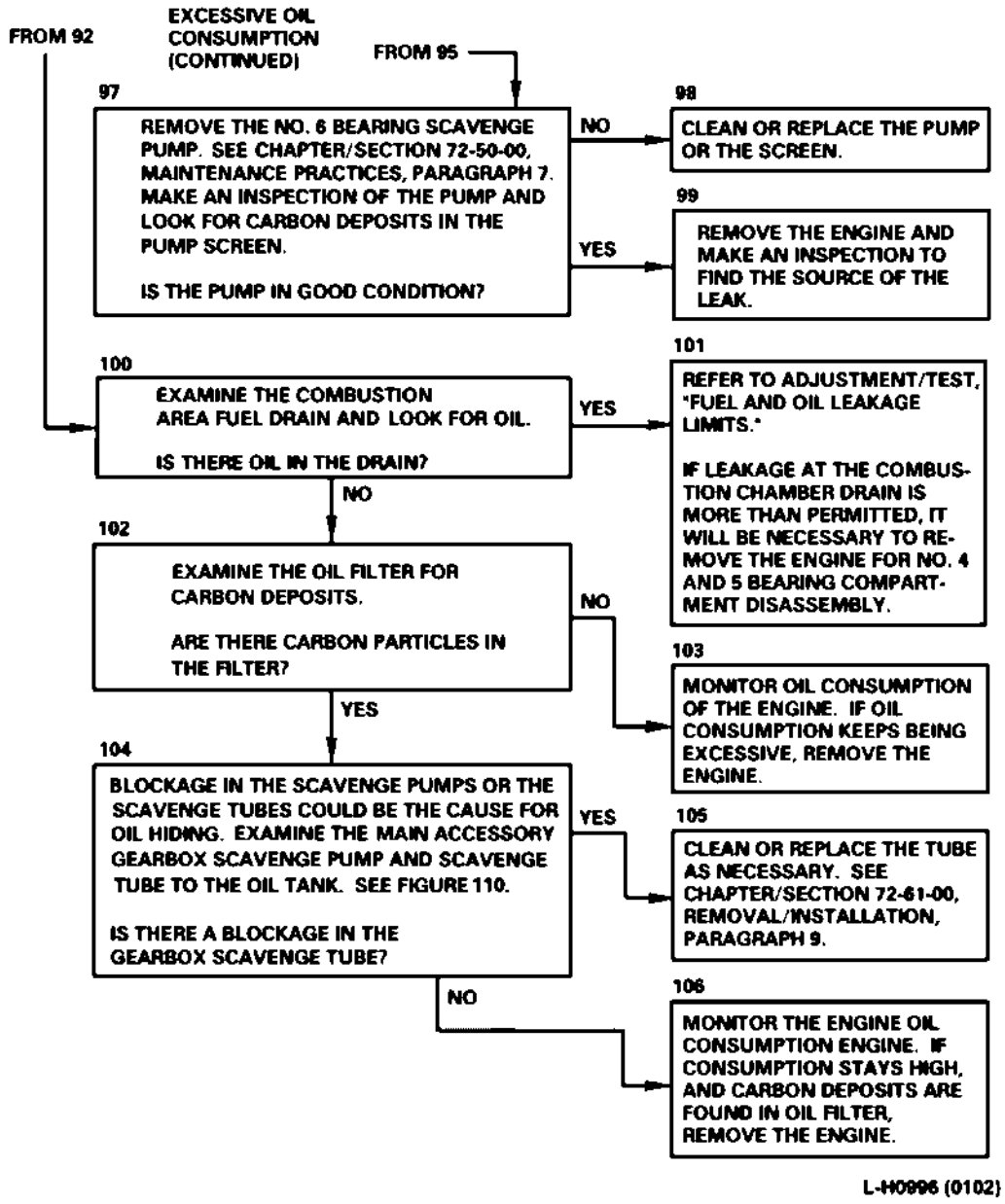

EXCESSIVE OIL CONSUMPTION (CONTINUED)
85
STEP 85: DELETED
FROM 80
86
YES
87
COMPARE THE PRESSURE RECORDS WITH THE MAXIMUM LIMITS AS FOLLOWS:
a. FOR JT8D-1, -1A,-1B, -7, -7A, -7B, -9, -9A ENGINES WITHOUT NO. 4 BEARING CARBON SEAL, BREATHER PRESSURE MUST NOT BE MORE THAN 8.0 IN. HG (3.9 PSI).
b. FOR JT8D-11, -15, -17, -17R ENGINES WITHOUT NO. 4 BEARING CARBON SEAL, BREATHER PRESSURE MUST NOT EXCEED 8.5 IN. HG (4.2 PSI).
c. FOR ALL ENGINES WITH NO. 4 BEARING CARBON SEAL (INSTALLED IN ORIGINAL BUILD OR BY SB 5250), BREATHER PRESSURE MUST NOT BE MORE THAN 7.13 IN. HG (3.5 PSI). IS THE MAXIMUM RECORDED BREATHER PRESSURE OVER THE MAXIMUM LIMITS?
NOTE 5: ENGINES WITH BREATHER PRESSURE TEST DONE WITH CONTINUOUS PERMANENT RECORDING EQUIPMENT CAN CONTINUE IN SERVICE IF THE STEADY STATE LIMIT OF 7.13 IN. HG (3.5 PSI) IS EXCEEDED NO MORE THAN 30 SECONDS AND THE PRESSURE LEVEL IS NOT OVER 10.16 IN. HG (5.0 PSI). PUT AN ENGINE ACCEPTED TO THIS ADDITIONAL LIMIT ON WATCH AND DO A TEST AGAIN EVERY 50 CYCLES AFTER THIS. TOTAL BREATHER PRESSURE MUST NOT BE MORE THAN 13 IN. HG (6.4 PSI), THAT IS, BACK PRESSURE FROM ANY DUCT ATTACHED TO THE BREATHER VENT MUST NOT BE MORE THAN THE DIFFERENCE BETWEEN ENGINE PRESSURE AND 13 IN. HG (6.4 PSI). IF THE PRESSURE READING FROM THE OIL TANK-MOUNTED GAGE FITTING IS NEAR THE LIMITS, DO THE ENGINE TEST WITH THE GAGE INSTALLED AT THE GEARBOX.
REPLACE ENGINE TO INSPECT AND REPAIR AS NECESSARY.
CAUTION 8: DO NOT RETURN THE ENGINE TO SERVICE IF IT HAS HIGH BREATHER PRESSURE. HIGH BREATHER PRESSURE SHOWS THAT THERE IS HIGH TEMPERATURE, HIGH PRESSURE AIR LEAKAGE INTO A BEARING COMPARTMENT, WHICH COULD BE DANGEROUS.
NO
GO ON TO STEP 88
L-H0994 (0605)

Excessive Oil Consumption
Troubleshooting
Figure 105 (Sheet 12)
(Task 72-00-00-810-004)

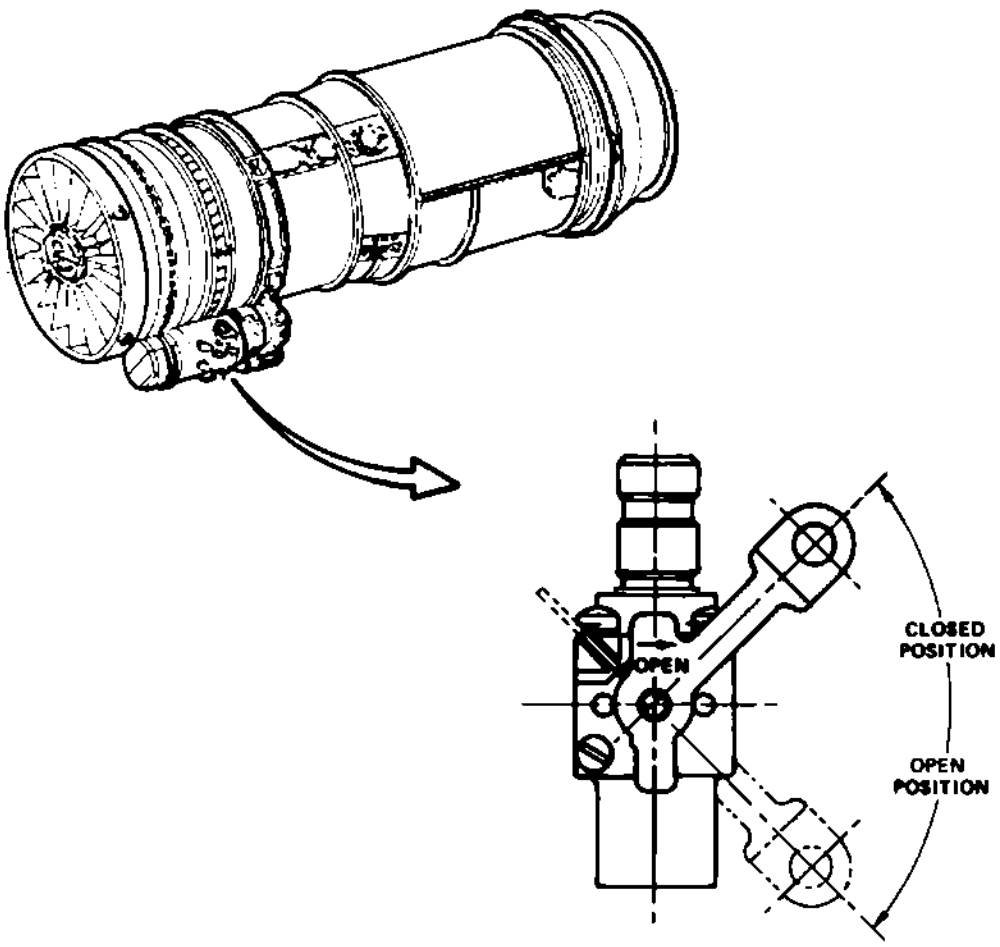

EXCESSIVE OIL CONSUMPTION (CONTINUED)
FROM 86
88
REMOVE THE TEST EQUIPMENT AND REINSTALL ENGINE FITTINGS.
FROM 75
89
REPLACE THE DEOILER CARBON SEAL. SEE CHAPTER/SECTION 72-61-00, REMOVAL/INSTALLATION, PARAGRAPH 8.
YES
90
IS THE ACCESSORY DRIVE SEAL DRAIN LEAKAGE OVER LIMITS?
NOTE 7: DO A BAG OR BOTTLE CHECK. DISCONNECT THE DRAIN LINES AT THE NACELLE DRAIN MAST AND INSTALL PLASTIC BAGS OR PROTEK BOTTLES. DO TEST "A" AND LOOK FOR LEAKAGE.
91
REPLACE THE DEFECTIVE SEAL. SEE CHAPTER/SECTION 72-61-00, REMOVAL/ INSTALLATION, PARAGRAPHS 1, 2, 4, 5 OR 7.
NO
92
AFTER SHUTDOWN, EXAMINE THE EXHAUST DUCTS FOR OIL.
IS LEAKAGE ABNORMAL?
NO
YES
YES
93
REMOVE THE TURBINE EXHAUST CONE. EXAMINE THE 4 1/2 AND 6 OIL TRANSFER TUBE FOR LEAKAGE.
IS THERE LEAKAGE?
94
TORQUE THE FITTINGS AGAIN OR REPLACE THE PACKINGS AS NECESSARY. USE SB 5704 PACKINGS.
NO
NO
95
EXAMINE THE NO. 6 BEARING COMPARTMENT FOR LEAKAGE.
IS THERE LEAKAGE?
96
REMOVE THE ENGINE AND MAKE AN INSPECTION TO FIND THE SOURCE OF THE LEAK.
YES
GO ON TO STEP 100
GO ON TO STEP 97

L-H0995 (0102)

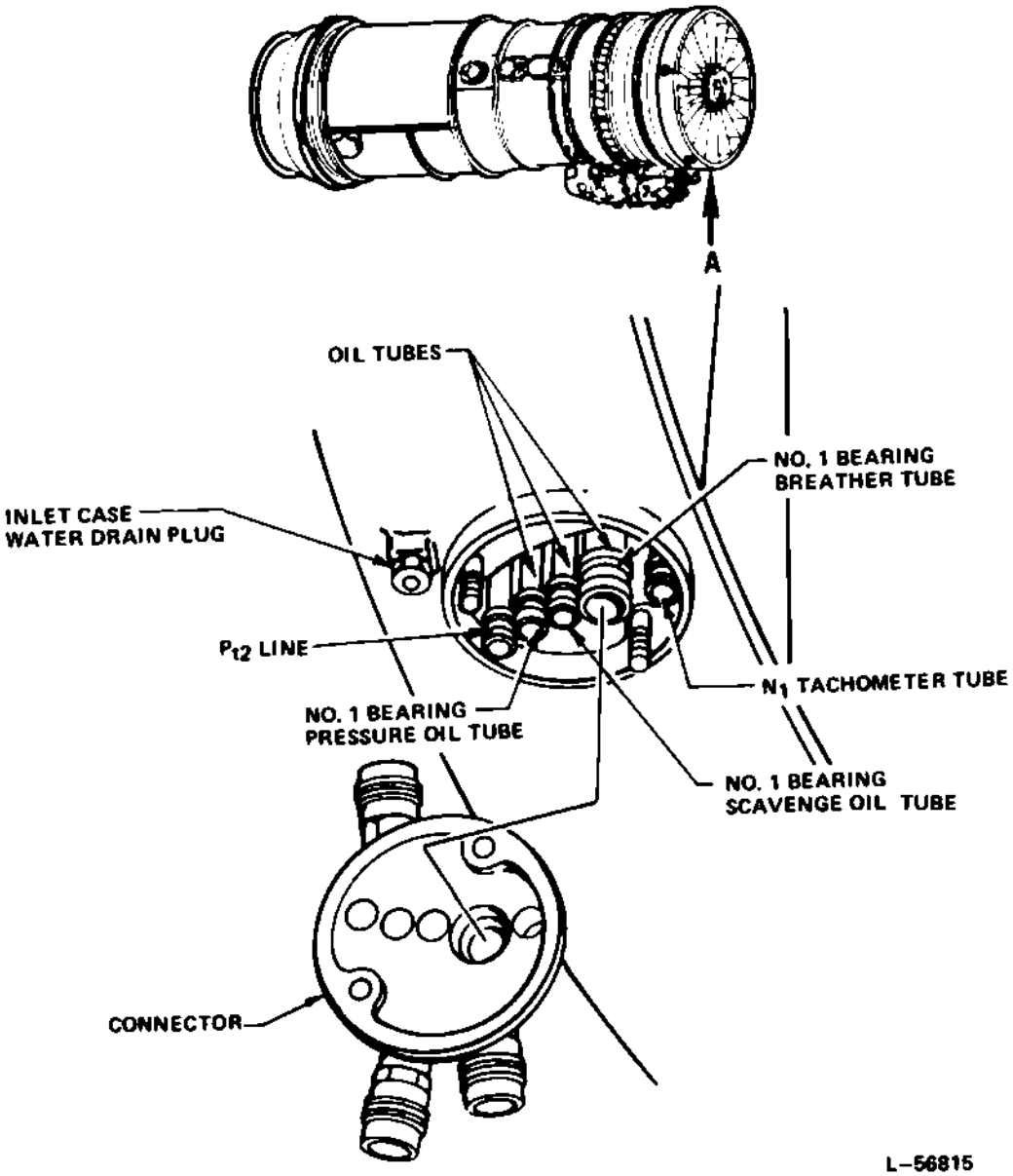
Excessive Oil Consumption
Troubleshooting
Figure 105 (Sheet 13)
(Task 72-00-00-810-004)


FROM 92
EXCESSIVE OIL CONSUMPTION (CONTINUED)
FROM 95
97
REMOVE THE NO. 6 BEARING SCAVENGE PUMP. SEE CHAPTER/SECTION 72-50-00, MAINTENANCE PRACTICES, PARAGRAPH 7. MAKE AN INSPECTION OF THE PUMP AND LOOK FOR CARBON DEPOSITS IN THE PUMP SCREEN.
IS THE PUMP IN GOOD CONDITION?
NO
98
CLEAN OR REPLACE THE PUMP OR THE SCREEN.
YES
99
REMOVE THE ENGINE AND MAKE AN INSPECTION TO FIND THE SOURCE OF THE LEAK.
100
EXAMINE THE COMBUSTION AREA FUEL DRAIN AND LOOK FOR OIL.
IS THERE OIL IN THE DRAIN?
YES
101
REFER TO ADJUSTMENT/TEST, "FUEL AND OIL LEAKAGE LIMITS."
IF LEAKAGE AT THE COMBUSTION CHAMBER DRAIN IS MORE THAN PERMITTED, IT WILL BE NECESSARY TO REMOVE THE ENGINE FOR NO. 4 AND 5 BEARING COMPARTMENT DISASSEMBLY.
NO
102
EXAMINE THE OIL FILTER FOR CARBON DEPOSITS.
ARE THERE CARBON PARTICLES IN THE FILTER?
NO
103
MONITOR OIL CONSUMPTION OF THE ENGINE. IF OIL CONSUMPTION KEEPS BEING EXCESSIVE, REMOVE THE ENGINE.
YES
104
BLOCKAGE IN THE SCAVENGE PUMPS OR THE SCAVENGE TUBES COULD BE THE CAUSE FOR OIL HIDING. EXAMINE THE MAIN ACCESSORY GEARBOX SCAVENGE PUMP AND SCAVENGE TUBE TO THE OIL TANK. SEE FIGURE 110.
IS THERE A BLOCKAGE IN THE GEARBOX SCAVENGE TUBE?
YES
105
CLEAN OR REPLACE THE TUBE AS NECESSARY. SEE CHAPTER/SECTION 72-61-00, REMOVAL/INSTALLATION, PARAGRAPH 9.
NO
106
MONITOR THE ENGINE OIL CONSUMPTION ENGINE. IF CONSUMPTION STAYS HIGH, AND CARBON DEPOSITS ARE FOUND IN OIL FILTER, REMOVE THE ENGINE.
L-H0996 (0102)

Excessive Oil Consumption
Troubleshooting
Figure 105 (Sheet 14)
(Task 72-00-00-810-004)

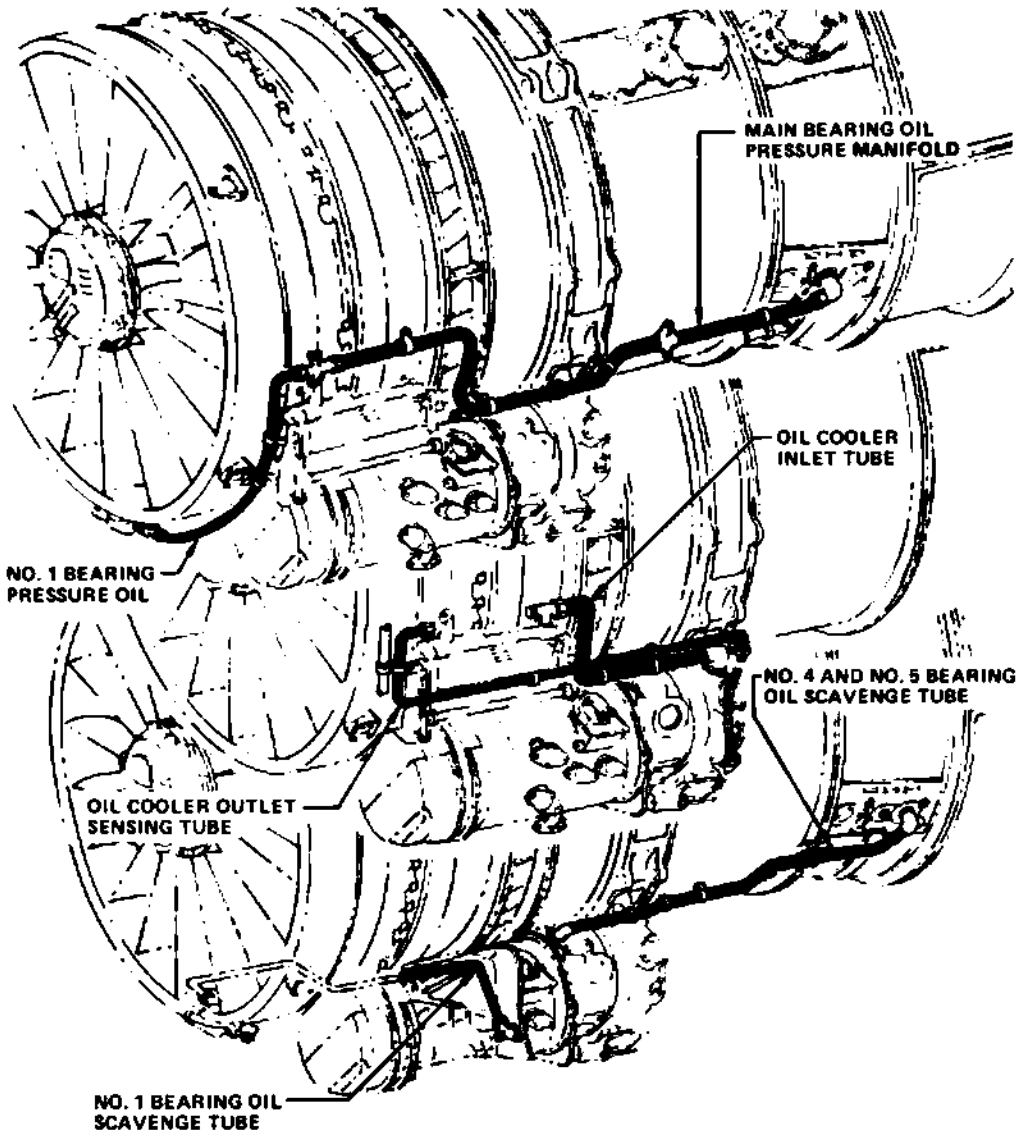


Oil Tank Drain Valve
Figure 106
(Task 72-00-00-810-004)

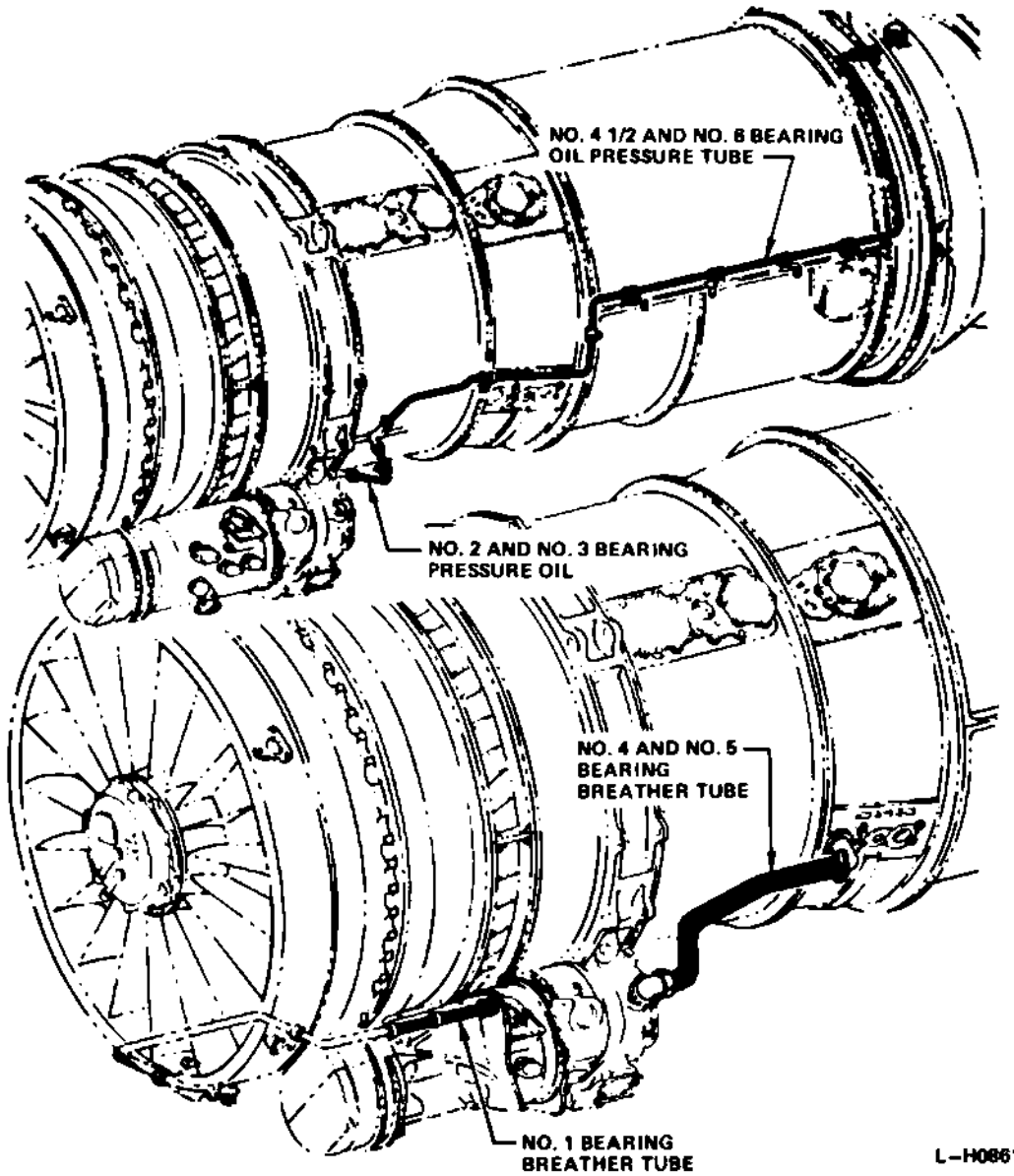


VIEW IN DIRECTION A
(UNDERSIDE OF INLET CASE)

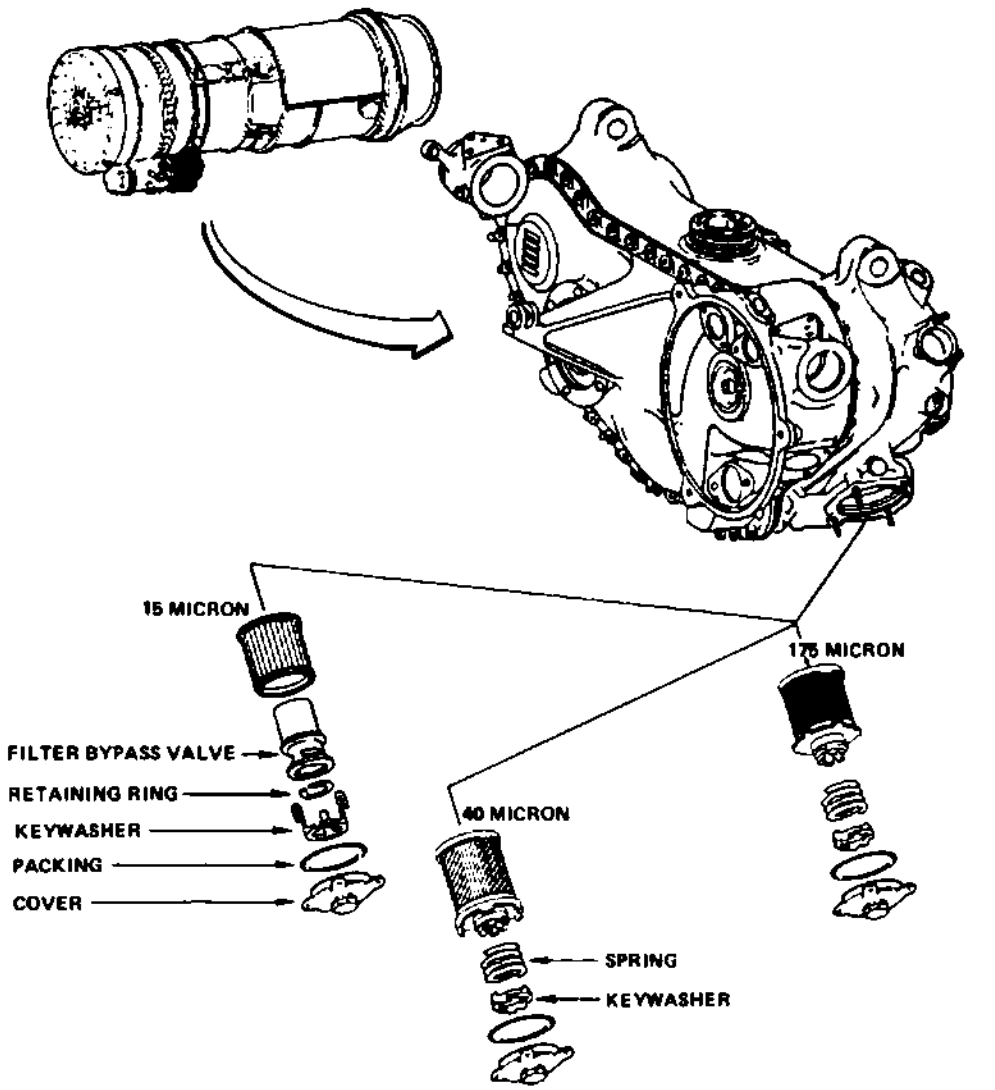
Inlet Case Strut Connector Check
Figure 107
(Task 72-00-00-810-004)


MAIN BEARING OIL PRESSURE MANIFOLD
OIL COOLER INLET TUBE
NO. 1 BEARING PRESSURE OIL
NO. 4 AND NO. 5 BEARING OIL SCAVENGE TUBE
OIL COOLER OUTLET SENSING TUBE
NO. 1 BEARING OIL SCAVENGE TUBE
L-H0860 (0000)

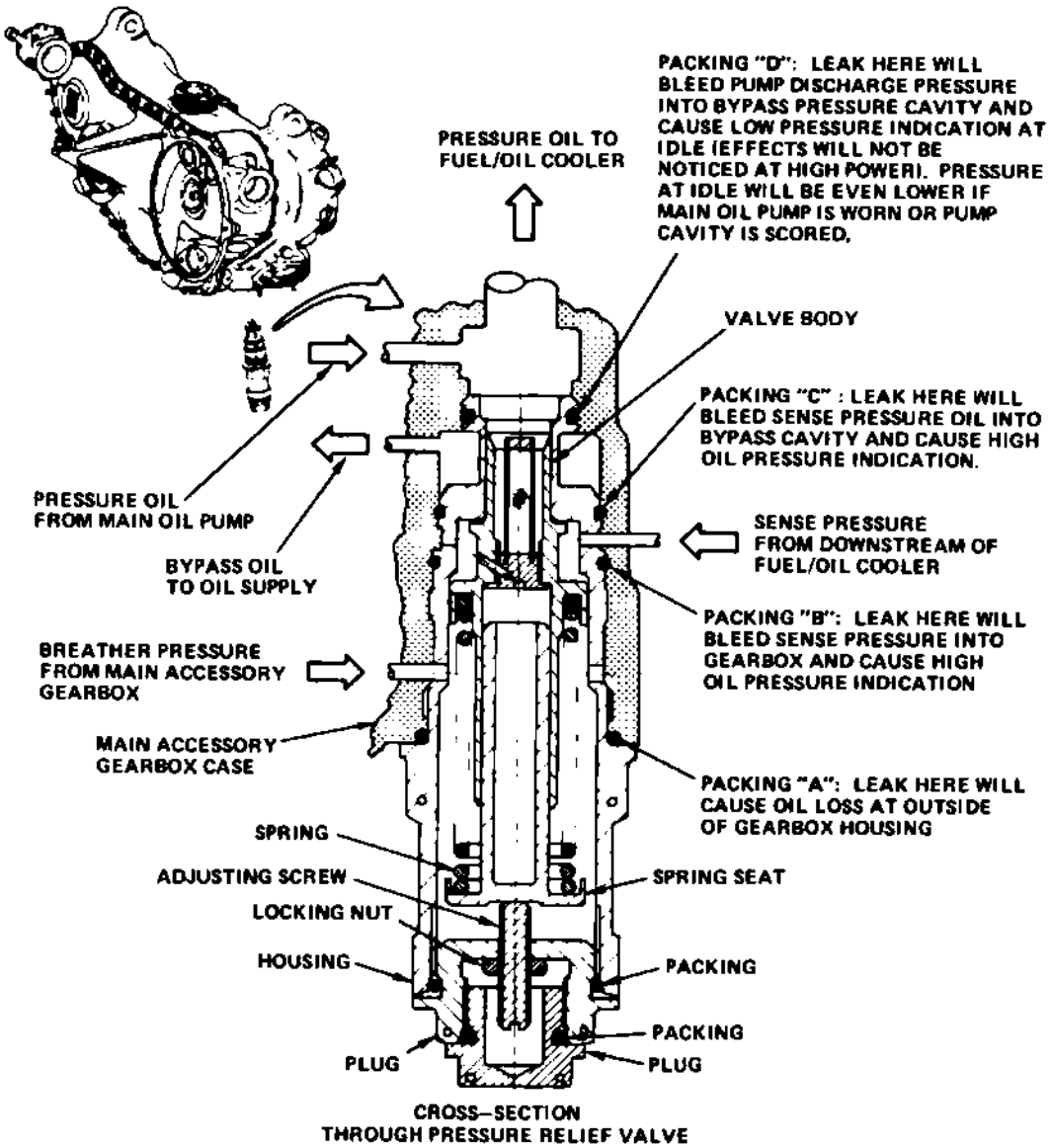
External Oil Tubes
Figure 108
(Task 72-00-00-810-004)


NO. 4 1/2 AND NO. 6 BEARING OIL PRESSURE TUBE
NO. 2 AND NO. 3 BEARING PRESSURE OIL
NO. 4 AND NO. 5 BEARING BREATHER TUBE
NO. 1 BEARING BREATHER TUBE
L-H0861

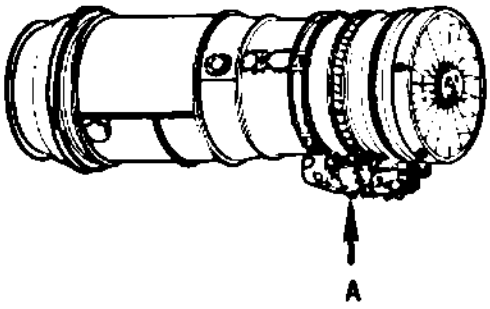
External Oil Tubes
And Breather Tubes
Figure 109
(Task 72-00-00-810-004)

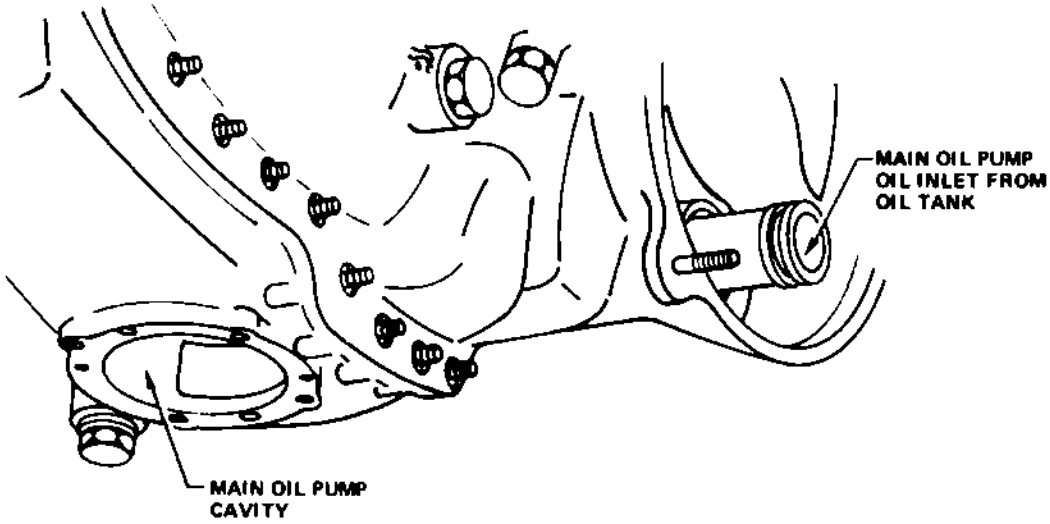


Main Oil Strainer
Figure 110
(Task 72-00-00-810-004)


PACKING "D": LEAK HERE WILL BLEED PUMP DISCHARGE PRESSURE INTO BYPASS PRESSURE CAVITY AND CAUSE LOW PRESSURE INDICATION AT IDLE (EFFECTS WILL NOT BE NOTICED AT HIGH POWER). PRESSURE AT IDLE WILL BE EVEN LOWER IF MAIN OIL PUMP IS WORN OR PUMP CAVITY IS SCORED.
PRESSURE OIL TO FUEL/OIL COOLER
VALVE BODY
PACKING "C" : LEAK HERE WILL BLEED SENSE PRESSURE OIL INTO BYPASS CAVITY AND CAUSE HIGH OIL PRESSURE INDICATION.
PRESSURE OIL FROM MAIN OIL PUMP
SENSE PRESSURE FROM DOWNSTREAM OF FUEL/OIL COOLER
BYPASS OIL TO OIL SUPPLY
PACKING "B": LEAK HERE WILL BLEED SENSE PRESSURE INTO GEARBOX AND CAUSE HIGH OIL PRESSURE INDICATION
BREATHER PRESSURE FROM MAIN ACCESSORY GEARBOX
MAIN ACCESSORY GEARBOX CASE
PACKING "A": LEAK HERE WILL CAUSE OIL LOSS AT OUTSIDE OF GEARBOX HOUSING
SPRING
ADJUSTING SCREW
SPRING SEAT
LOCKING NUT
HOUSING
PACKING
PACKING
PLUG
PLUG
CROSS-SECTION THROUGH PRESSURE RELIEF VALVE
L-H0554 (0000)

Oil Pressure Regulating Valve
Figure 111
(Task 72-00-00-810-004)

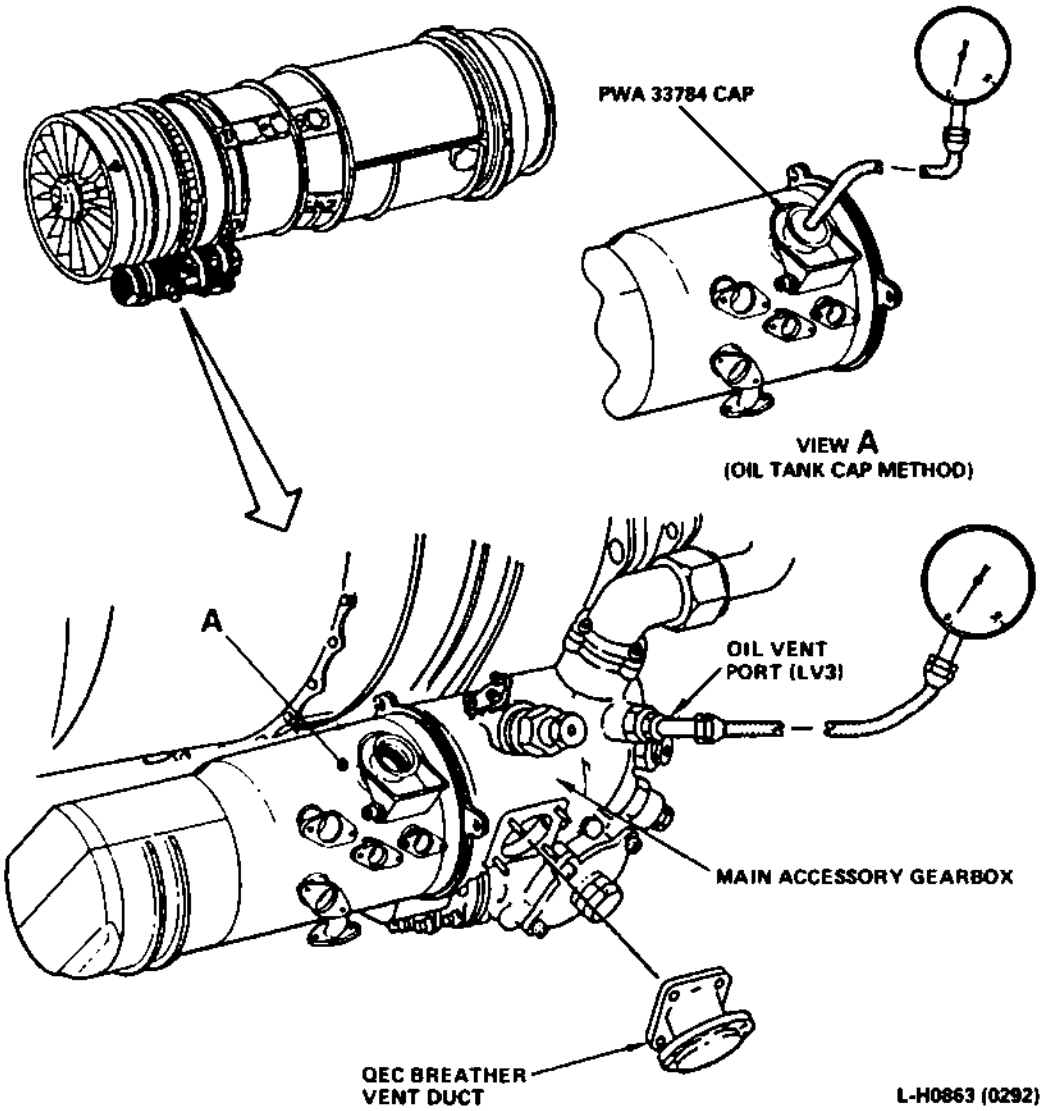




VIEW IN DIRECTION A
(MAIN OIL PUMP AND OIL TANK REMOVED)

L-56814
9-76

Main Oil Pump/Oil
Tank Passage Check
Figure 112
(Task 72-00-00-810-004)



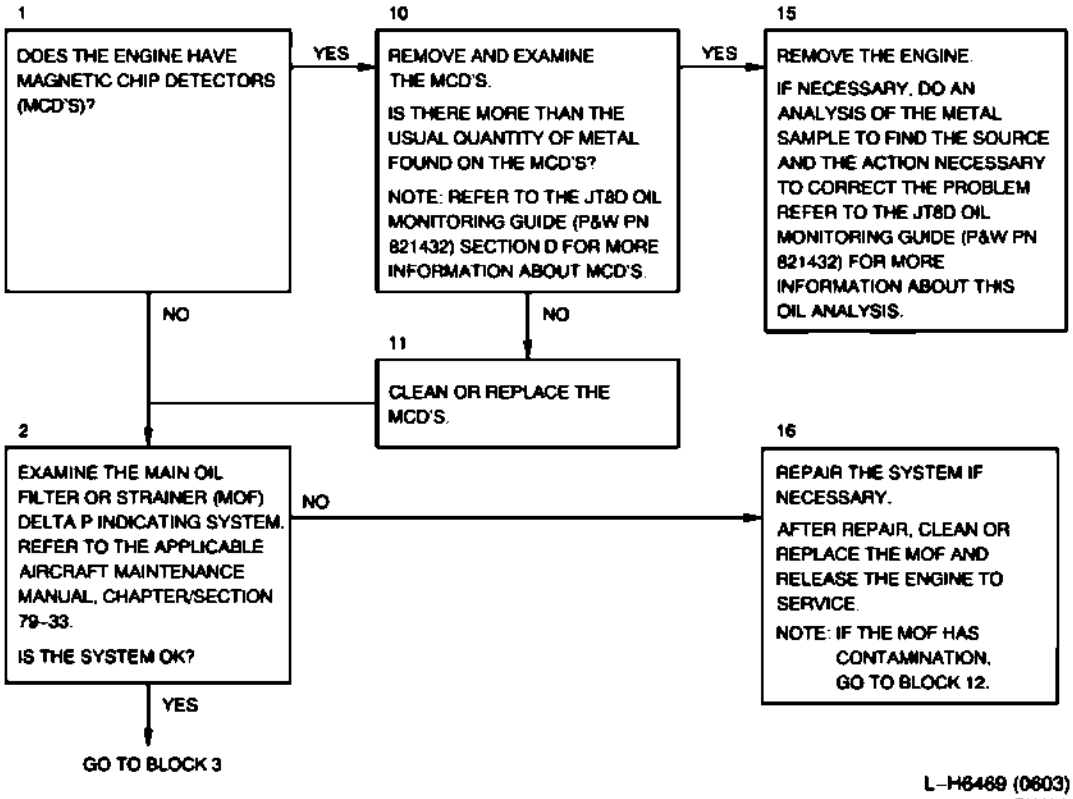
Gearbox Housing Breather
Pressure Instrumentation
Figure 113
(Task 72-00-00-810-004)

OIL FILTER/STRAINER DIFFERENTIAL PRESSURE
(DELTA P) LIGHT ON

FAULT DESCRIPTION: THE MAIN OIL FILTER/STRAINER DIFFERENTIAL PRESSURE LIGHT COMES ON. IT IS POSSIBLE THAT THE FILTER/STRAINER IS CLOGGED.

FREQUENT CAUSES: AIRCRAFT INDICATING SYSTEM OR OIL SYSTEM CONTAMINATION.

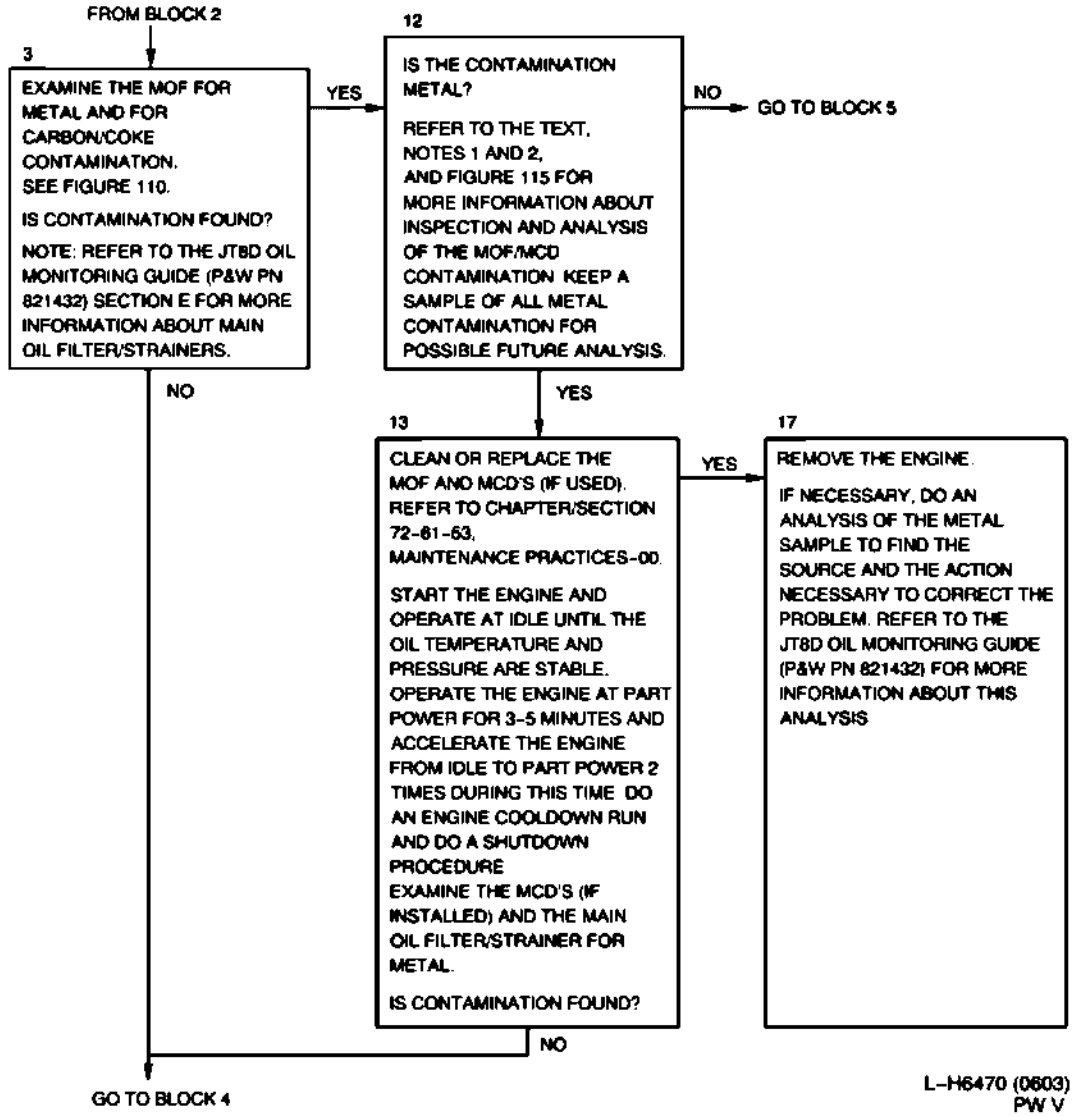
NOTE: THE SEQUENCE OF EVENTS SHOWN BELOW IS A SUGGESTION. RELATED TO THE PROBABILITY THAT THE STEP WILL IDENTIFY THE CAUSE, HOW EASY THE STEP IS TO DO, AND WHAT EFFECT THE CORRECTIVE ACTION WILL HAVE. IT IS PERMITTED TO CHANGE THE STEP SEQUENCE IF ENGINE EXPERIENCE SHOWS THAT THIS IS NECESSARY.


1
DOES THE ENGINE HAVE MAGNETIC CHIP DETECTORS (MCD'S)?
YES
10
REMOVE AND EXAMINE THE MCD'S.
IS THERE MORE THAN THE USUAL QUANTITY OF METAL FOUND ON THE MCD'S?
NOTE: REFER TO THE JT8D OIL MONITORING GUIDE (P&W PN 821432) SECTION D FOR MORE INFORMATION ABOUT MCD'S.
YES
15
REMOVE THE ENGINE.
IF NECESSARY, DO AN ANALYSIS OF THE METAL SAMPLE TO FIND THE SOURCE AND THE ACTION NECESSARY TO CORRECT THE PROBLEM REFER TO THE JT8D OIL MONITORING GUIDE (P&W PN 821432) FOR MORE INFORMATION ABOUT THIS OIL ANALYSIS.
NO
NO
11
CLEAN OR REPLACE THE MCD'S.
2
EXAMINE THE MAIN OIL FILTER OR STRAINER (MOF) DELTA P INDICATING SYSTEM. REFER TO THE APPLICABLE AIRCRAFT MAINTENANCE MANUAL, CHAPTER/SECTION 79-33.
IS THE SYSTEM OK?
NO
16
REPAIR THE SYSTEM IF NECESSARY.
AFTER REPAIR, CLEAN OR REPLACE THE MOF AND RELEASE THE ENGINE TO SERVICE.
NOTE: IF THE MOF HAS CONTAMINATION, GO TO BLOCK 12.
YES
GO TO BLOCK 3

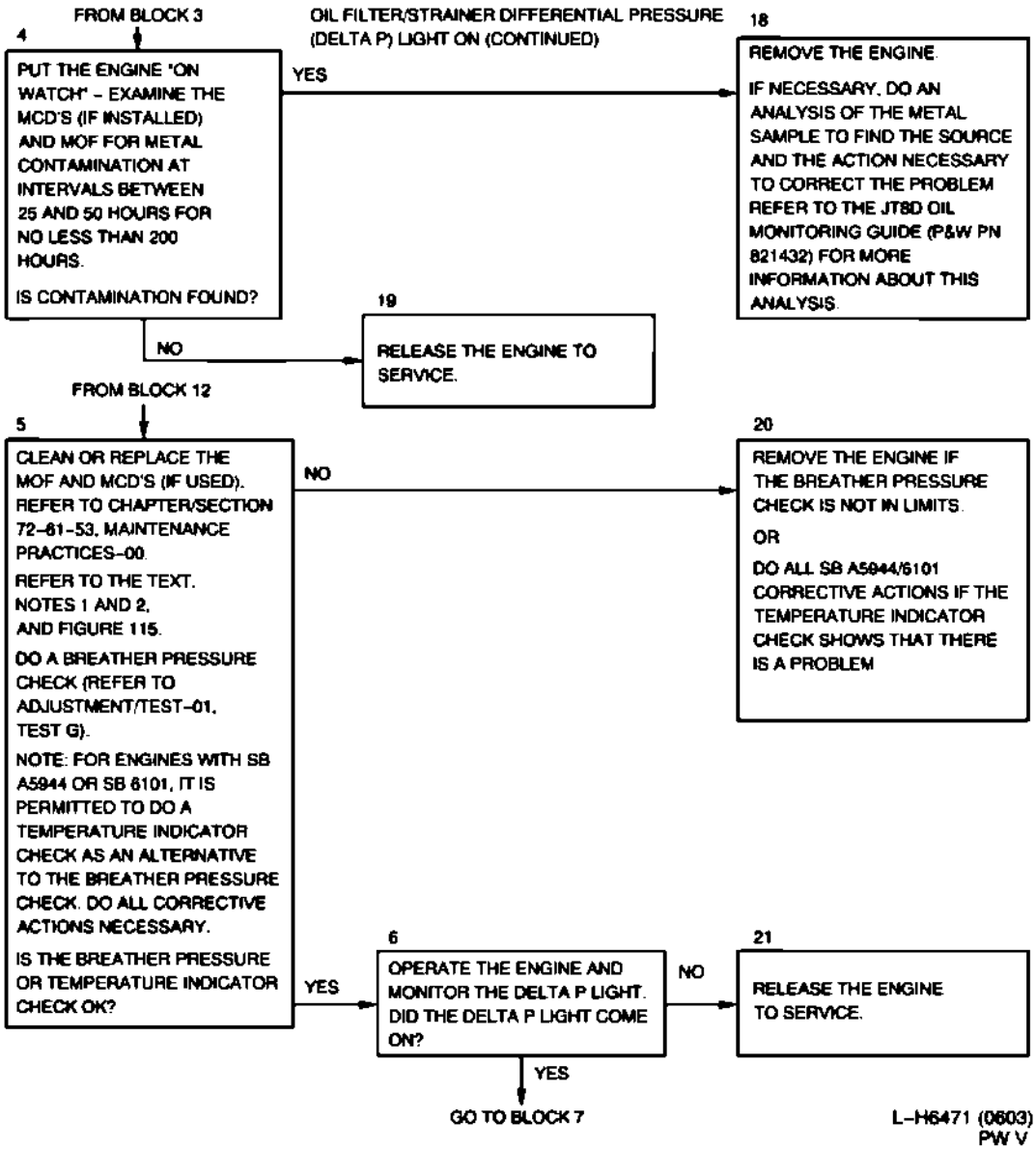
L-H6469 (0603)
PW V

Oil Filter/Strainer
Differential Pressure Light On
Figure 114 (Sheet 1)
(Task 72-00-00-810-004)

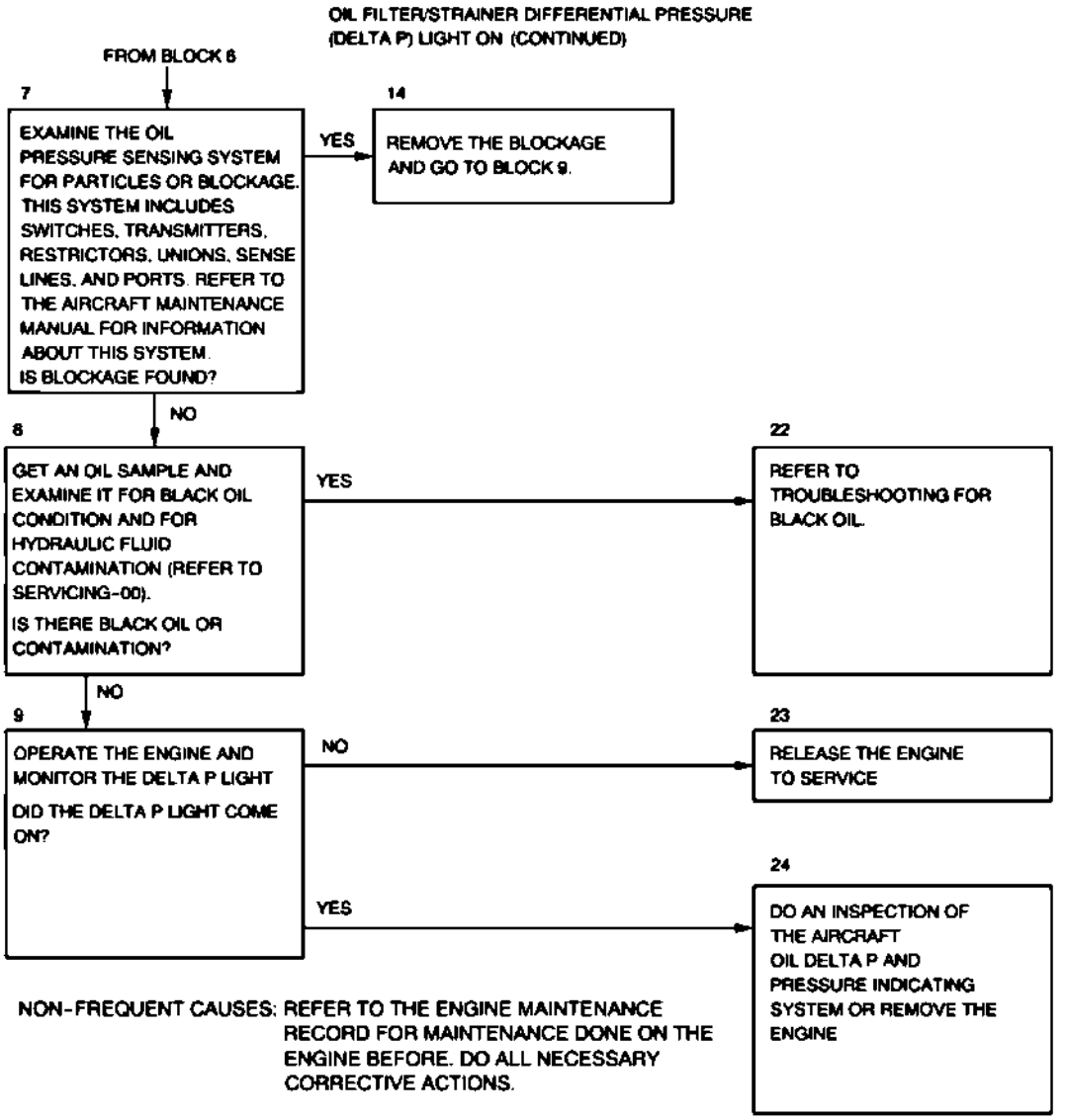
OIL FILTER/STRAINER DIFFERENTIAL PRESSURE
(DELTA P) LIGHT ON (CONTINUED)


FROM BLOCK 2
3
EXAMINE THE MOF FOR METAL AND FOR CARBON/COKE CONTAMINATION. SEE FIGURE 110.
IS CONTAMINATION FOUND?
NOTE: REFER TO THE JT8D OIL MONITORING GUIDE (P&W PN 821432) SECTION E FOR MORE INFORMATION ABOUT MAIN OIL FILTER/STRAINERS.
YES
12
IS THE CONTAMINATION METAL?
REFER TO THE TEXT, NOTES 1 AND 2, AND FIGURE 115 FOR MORE INFORMATION ABOUT INSPECTION AND ANALYSIS OF THE MOF/MCD CONTAMINATION. KEEP A SAMPLE OF ALL METAL CONTAMINATION FOR POSSIBLE FUTURE ANALYSIS.
NO
GO TO BLOCK 5
NO
YES
13
CLEAN OR REPLACE THE MOF AND MCD'S (IF USED). REFER TO CHAPTER/SECTION 72-61-53, MAINTENANCE PRACTICES-00.
START THE ENGINE AND OPERATE AT IDLE UNTIL THE OIL TEMPERATURE AND PRESSURE ARE STABLE. OPERATE THE ENGINE AT PART POWER FOR 3-5 MINUTES AND ACCELERATE THE ENGINE FROM IDLE TO PART POWER 2 TIMES DURING THIS TIME. DO AN ENGINE COOLDOWN RUN AND DO A SHUTDOWN PROCEDURE
EXAMINE THE MCD'S (IF INSTALLED) AND THE MAIN OIL FILTER/STRAINER FOR METAL.
IS CONTAMINATION FOUND?
YES
17
REMOVE THE ENGINE.
IF NECESSARY, DO AN ANALYSIS OF THE METAL SAMPLE TO FIND THE SOURCE AND THE ACTION NECESSARY TO CORRECT THE PROBLEM. REFER TO THE JT8D OIL MONITORING GUIDE (P&W PN 821432) FOR MORE INFORMATION ABOUT THIS ANALYSIS
NO
GO TO BLOCK 4
L-H6470 (0603)
PW V

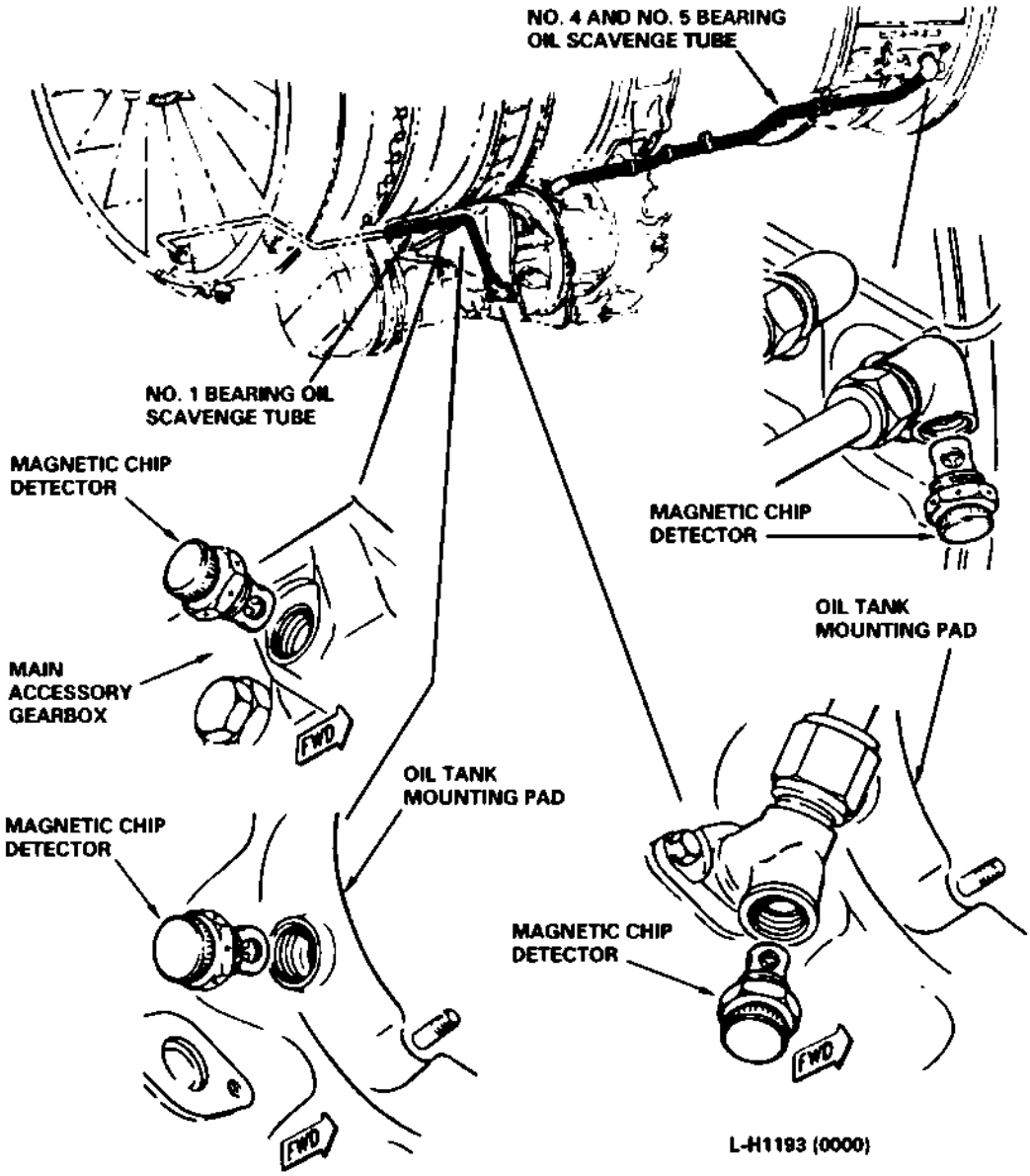
Oil Filter/Strainer
Differential Pressure Light On
Figure 114 (Sheet 2)
(Task 72-00-00-810-004)


FROM BLOCK 3
4
PUT THE ENGINE "ON WATCH" - EXAMINE THE MCD'S (IF INSTALLED) AND MOF FOR METAL CONTAMINATION AT INTERVALS BETWEEN 25 AND 50 HOURS FOR NO LESS THAN 200 HOURS.
IS CONTAMINATION FOUND?
YES
OIL FILTER/STRAINER DIFFERENTIAL PRESSURE (DELTA P) LIGHT ON (CONTINUED)
18
REMOVE THE ENGINE.
IF NECESSARY, DO AN ANALYSIS OF THE METAL SAMPLE TO FIND THE SOURCE AND THE ACTION NECESSARY TO CORRECT THE PROBLEM. REFER TO THE JT8D OIL MONITORING GUIDE (P&W PN 821432) FOR MORE INFORMATION ABOUT THIS ANALYSIS.
NO
19
RELEASE THE ENGINE TO SERVICE.
FROM BLOCK 12
5
CLEAN OR REPLACE THE MOF AND MCD'S (IF USED). REFER TO CHAPTER/SECTION 72-61-53, MAINTENANCE PRACTICES-00.
REFER TO THE TEXT, NOTES 1 AND 2, AND FIGURE 115.
DO A BREATHER PRESSURE CHECK (REFER TO ADJUSTMENT/TEST-01, TEST G).
NOTE: FOR ENGINES WITH SB A5944 OR SB 6101, IT IS PERMITTED TO DO A TEMPERATURE INDICATOR CHECK AS AN ALTERNATIVE TO THE BREATHER PRESSURE CHECK. DO ALL CORRECTIVE ACTIONS NECESSARY.
IS THE BREATHER PRESSURE OR TEMPERATURE INDICATOR CHECK OK?
NO
20
REMOVE THE ENGINE IF THE BREATHER PRESSURE CHECK IS NOT IN LIMITS.
OR
DO ALL SB A5944/6101 CORRECTIVE ACTIONS IF THE TEMPERATURE INDICATOR CHECK SHOWS THAT THERE IS A PROBLEM
YES
6
OPERATE THE ENGINE AND MONITOR THE DELTA P LIGHT. DID THE DELTA P LIGHT COME ON?
NO
21
RELEASE THE ENGINE TO SERVICE.
YES
GO TO BLOCK 7
L-H6471 (0603)
PW V

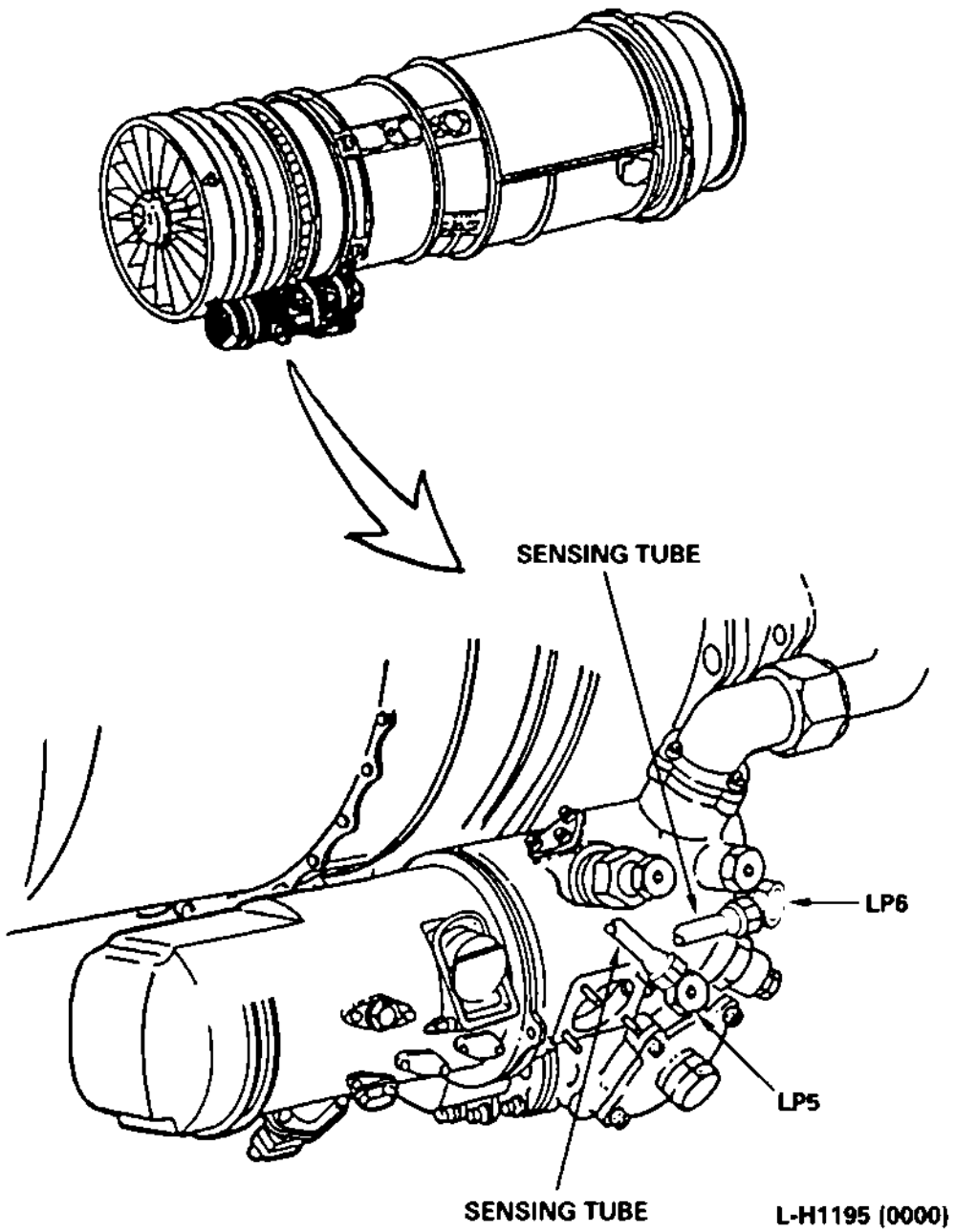
Oil Filter/Strainer
Differential Pressure Light On
Figure 114 (Sheet 3)
(Task 72-00-00-810-004)


OIL FILTER/STRAINER DIFFERENTIAL PRESSURE (DELTA P) LIGHT ON (CONTINUED)
FROM BLOCK 6
7
EXAMINE THE OIL PRESSURE SENSING SYSTEM FOR PARTICLES OR BLOCKAGE. THIS SYSTEM INCLUDES SWITCHES, TRANSMITTERS, RESTRICTORS, UNIONS, SENSE LINES, AND PORTS. REFER TO THE AIRCRAFT MAINTENANCE MANUAL FOR INFORMATION ABOUT THIS SYSTEM.
IS BLOCKAGE FOUND?
YES
14
REMOVE THE BLOCKAGE AND GO TO BLOCK 9.
NO
8
GET AN OIL SAMPLE AND EXAMINE IT FOR BLACK OIL CONDITION AND FOR HYDRAULIC FLUID CONTAMINATION (REFER TO SERVICING-00).
IS THERE BLACK OIL OR CONTAMINATION?
YES
22
REFER TO TROUBLESHOOTING FOR BLACK OIL.
NO
9
OPERATE THE ENGINE AND MONITOR THE DELTA P LIGHT
DID THE DELTA P LIGHT COME ON?
NO
23
RELEASE THE ENGINE TO SERVICE
YES
24
DO AN INSPECTION OF THE AIRCRAFT OIL DELTA P AND PRESSURE INDICATING SYSTEM OR REMOVE THE ENGINE
NON-FREQUENT CAUSES: REFER TO THE ENGINE MAINTENANCE RECORD FOR MAINTENANCE DONE ON THE ENGINE BEFORE. DO ALL NECESSARY CORRECTIVE ACTIONS.
L-H6472 (0603)
PW V

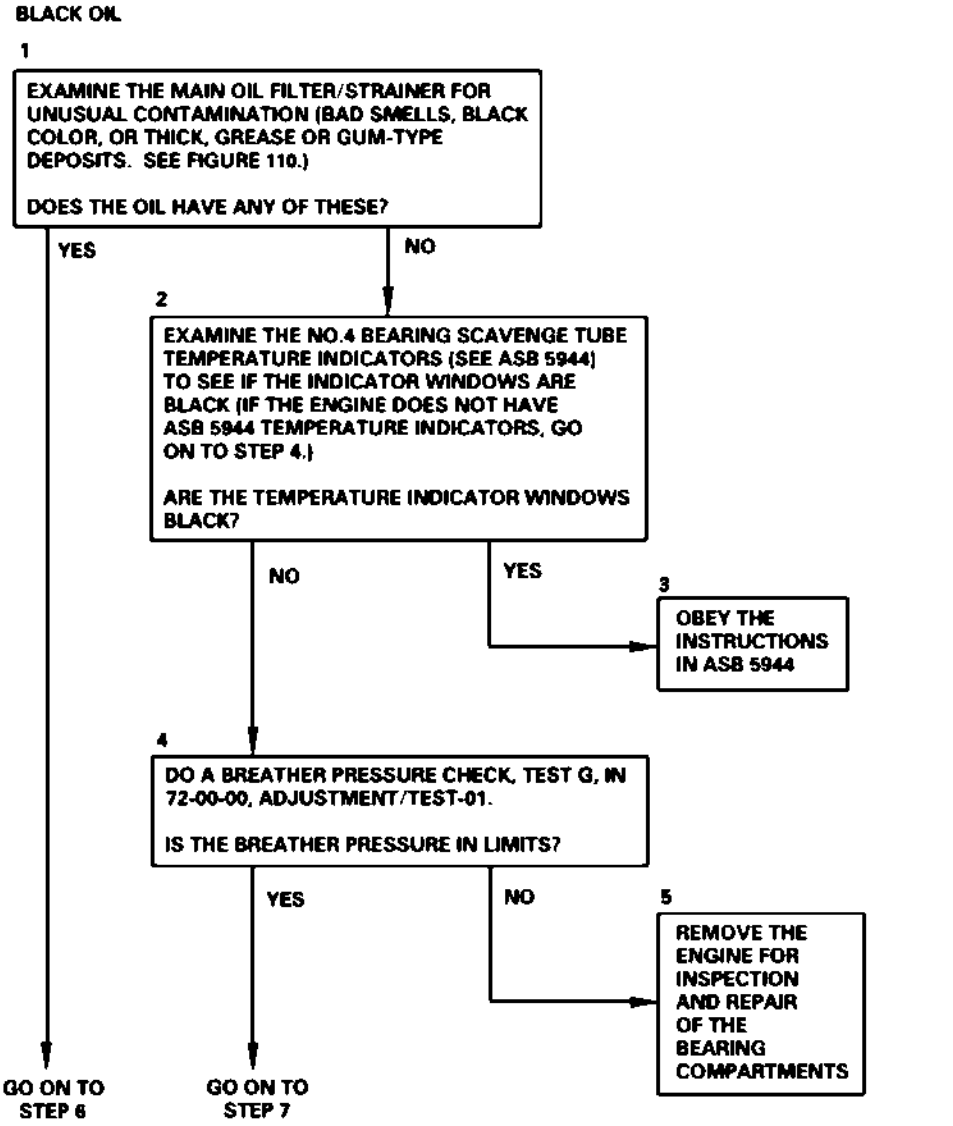
Oil Filter Differential
Pressure Light On
Figure 114 (Sheet 4)
(Task 72-00-00-810-004)



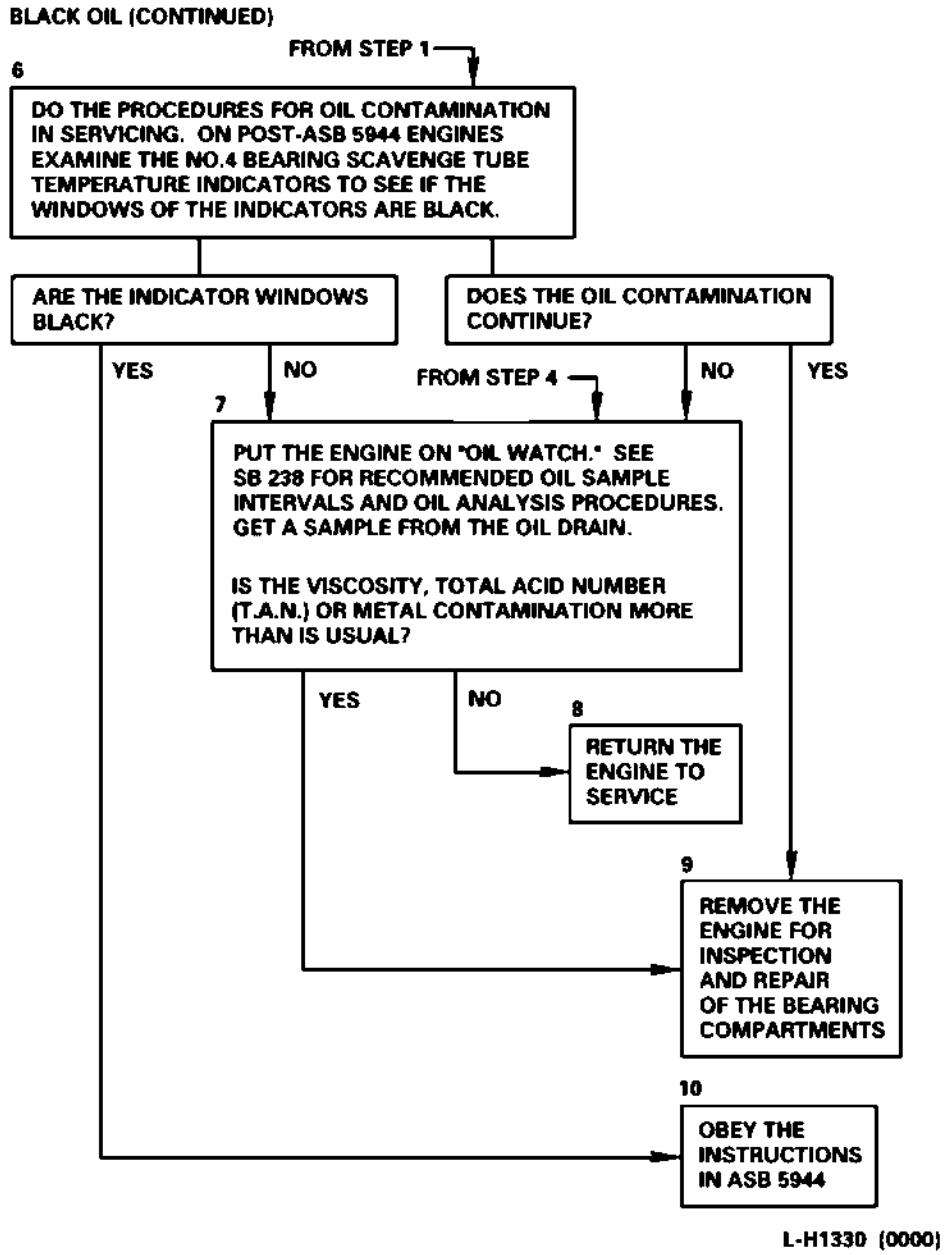
Magnetic Chip Detectors
Optional Locations
Figure 115
(Task 72-00-00-810-004)



Airframe (Delta P) Sensing Tubes
Figure 116
(Task 72-00-00-810-004)

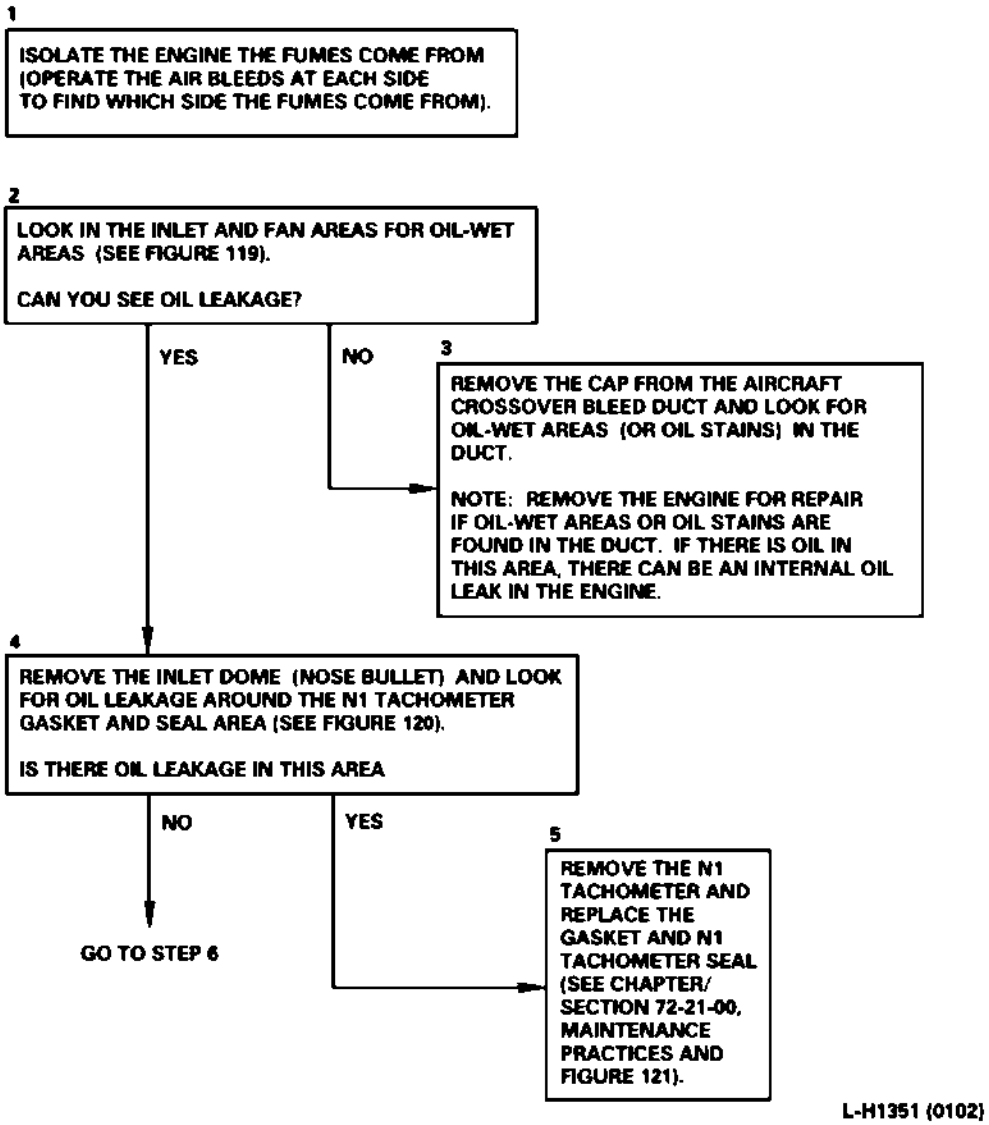

BLACK OIL
1
EXAMINE THE MAIN OIL FILTER/STRAINER FOR UNUSUAL CONTAMINATION (BAD SMELLS, BLACK COLOR, OR THICK, GREASE OR GUM-TYPE DEPOSITS. SEE FIGURE 110.)
DOES THE OIL HAVE ANY OF THESE?
YES
NO
2
EXAMINE THE NO.4 BEARING SCAVENGE TUBE TEMPERATURE INDICATORS (SEE ASB 5944) TO SEE IF THE INDICATOR WINDOWS ARE BLACK (IF THE ENGINE DOES NOT HAVE ASB 5944 TEMPERATURE INDICATORS, GO ON TO STEP 4.)
ARE THE TEMPERATURE INDICATOR WINDOWS BLACK?
NO
YES
3
OBEY THE INSTRUCTIONS IN ASB 5944
4
DO A BREATHER PRESSURE CHECK, TEST G, IN 72-00-00, ADJUSTMENT/TEST-01.
IS THE BREATHER PRESSURE IN LIMITS?
YES
NO
5
REMOVE THE ENGINE FOR INSPECTION AND REPAIR OF THE BEARING COMPARTMENTS
GO ON TO STEP 6
GO ON TO STEP 7
L-H1329 (0102)

Black Oil Troubleshooting
Figure 117 (Sheet 1)
(Task 72-00-00-810-004)


BLACK OIL (CONTINUED)
FROM STEP 1
6
DO THE PROCEDURES FOR OIL CONTAMINATION IN SERVICING. ON POST-ASB 5944 ENGINES EXAMINE THE NO.4 BEARING SCAVENGE TUBE TEMPERATURE INDICATORS TO SEE IF THE WINDOWS OF THE INDICATORS ARE BLACK.
ARE THE INDICATOR WINDOWS BLACK?
DOES THE OIL CONTAMINATION CONTINUE?
YES
NO
FROM STEP 4
NO
YES
7
PUT THE ENGINE ON "OIL WATCH." SEE SB 238 FOR RECOMMENDED OIL SAMPLE INTERVALS AND OIL ANALYSIS PROCEDURES. GET A SAMPLE FROM THE OIL DRAIN.
IS THE VISCOSITY, TOTAL ACID NUMBER (T.A.N.) OR METAL CONTAMINATION MORE THAN IS USUAL?
YES
NO
8
RETURN THE ENGINE TO SERVICE
9
REMOVE THE ENGINE FOR INSPECTION AND REPAIR OF THE BEARING COMPARTMENTS
10
OBEY THE INSTRUCTIONS IN ASB 5944
L-H1330 (0000)

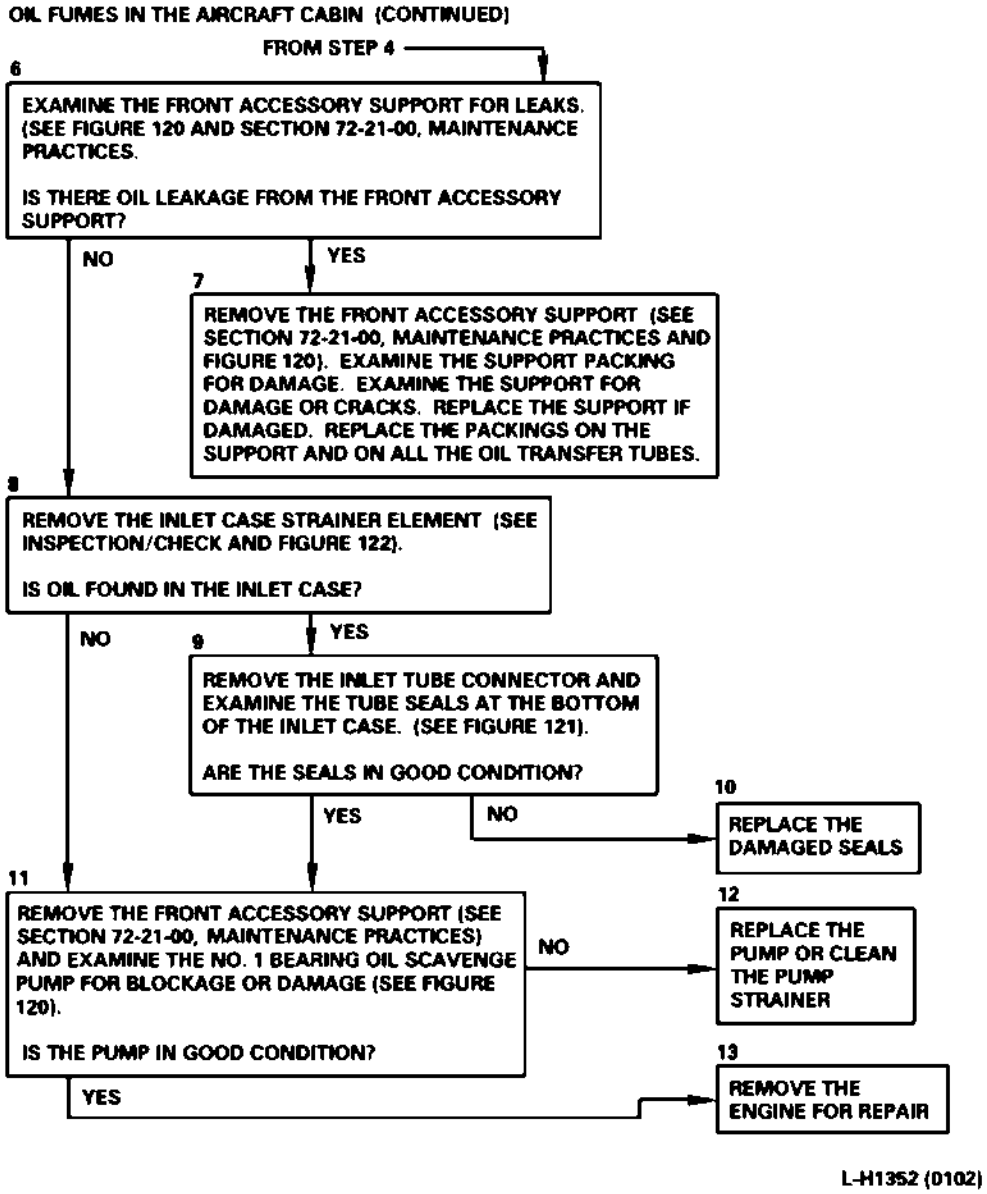
Black Oil Troubleshooting
Figure 117 (Sheet 2)
(Task 72-00-00-810-004)

OIL FUMES IN THE AIRCRAFT CABIN

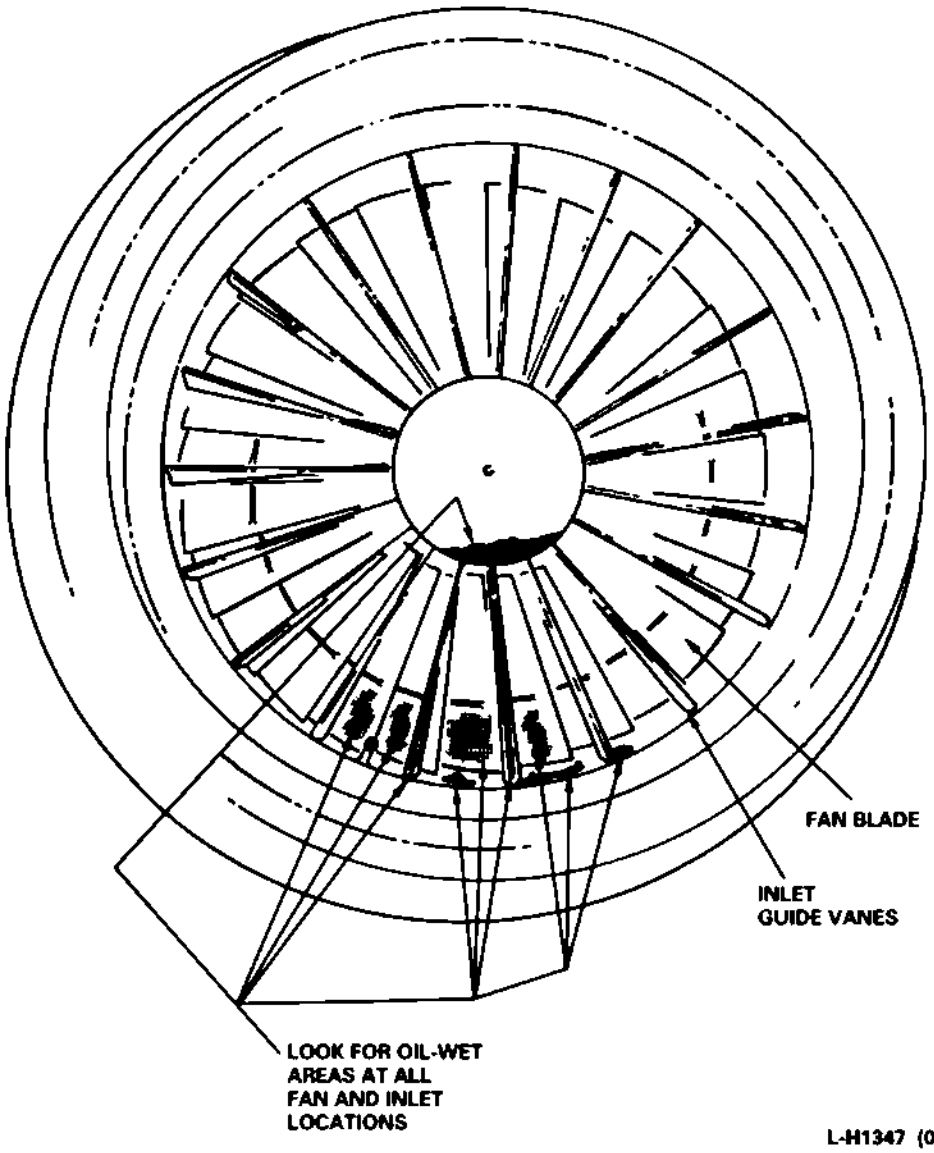

1
ISOLATE THE ENGINE THE FUMES COME FROM (OPERATE THE AIR BLEEDS AT EACH SIDE TO FIND WHICH SIDE THE FUMES COME FROM).
2
LOOK IN THE INLET AND FAN AREAS FOR OIL-WET AREAS (SEE FIGURE 119).
CAN YOU SEE OIL LEAKAGE?
YES
NO
3
REMOVE THE CAP FROM THE AIRCRAFT CROSSOVER BLEED DUCT AND LOOK FOR OIL-WET AREAS (OR OIL STAINS) IN THE DUCT.
NOTE: REMOVE THE ENGINE FOR REPAIR IF OIL-WET AREAS OR OIL STAINS ARE FOUND IN THE DUCT. IF THERE IS OIL IN THIS AREA, THERE CAN BE AN INTERNAL OIL LEAK IN THE ENGINE.
4
REMOVE THE INLET DOME (NOSE BULLET) AND LOOK FOR OIL LEAKAGE AROUND THE N1 TACHOMETER GASKET AND SEAL AREA (SEE FIGURE 120).
IS THERE OIL LEAKAGE IN THIS AREA
NO
YES
GO TO STEP 6
5
REMOVE THE N1 TACHOMETER AND REPLACE THE GASKET AND N1 TACHOMETER SEAL (SEE CHAPTER/ SECTION 72-21-00, MAINTENANCE PRACTICES AND FIGURE 121).

L-H1351 (0102)

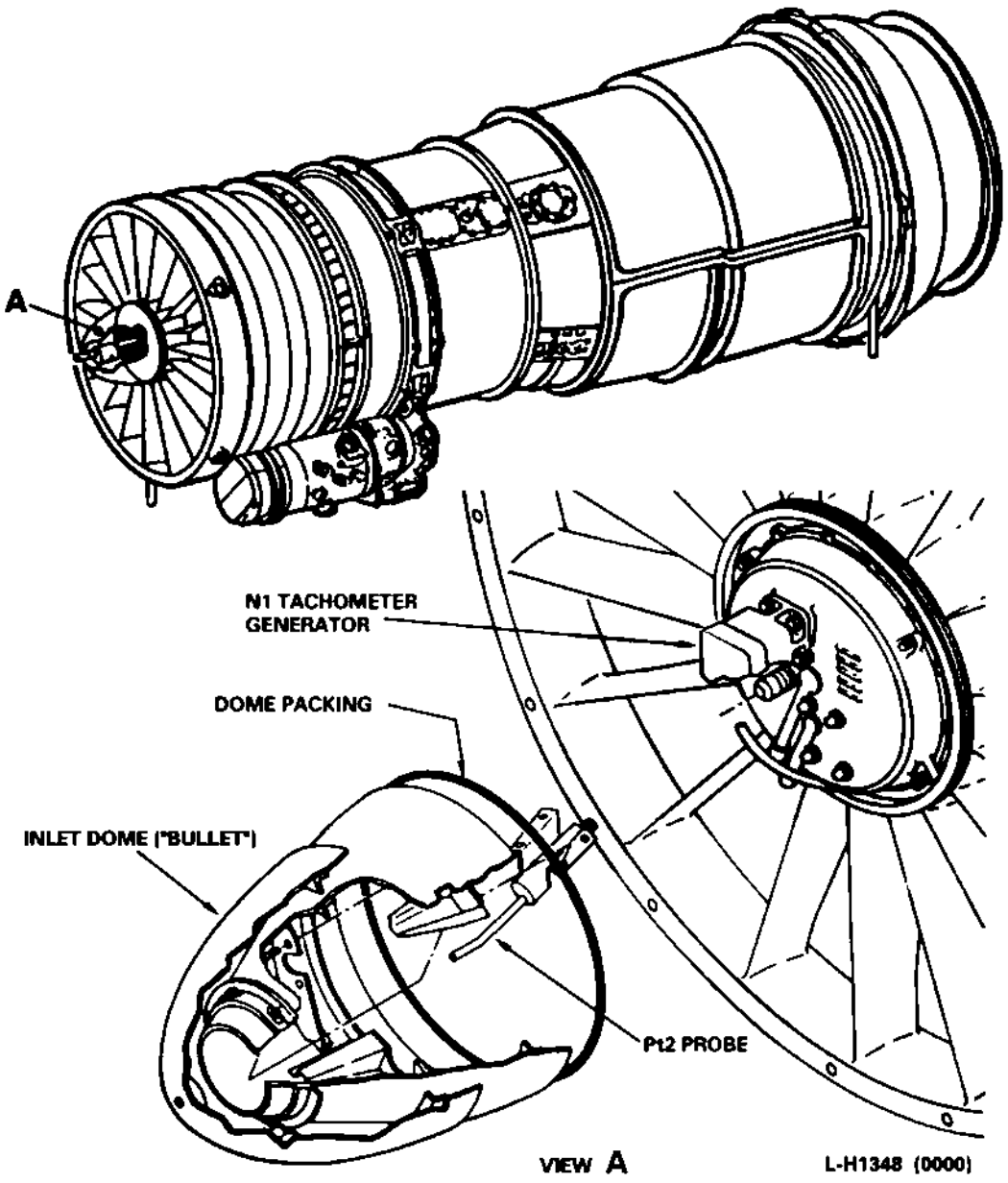
Oil Fumes In The
Cabin Troubleshooting
Figure 118 (Sheet 1)
(Task 72-00-00-810-004)


OIL FUMES IN THE AIRCRAFT CABIN (CONTINUED)
FROM STEP 4
6
EXAMINE THE FRONT ACCESSORY SUPPORT FOR LEAKS. (SEE FIGURE 120 AND SECTION 72-21-00, MAINTENANCE PRACTICES.
IS THERE OIL LEAKAGE FROM THE FRONT ACCESSORY SUPPORT?
NO
YES
7
REMOVE THE FRONT ACCESSORY SUPPORT (SEE SECTION 72-21-00, MAINTENANCE PRACTICES AND FIGURE 120). EXAMINE THE SUPPORT PACKING FOR DAMAGE. EXAMINE THE SUPPORT FOR DAMAGE OR CRACKS. REPLACE THE SUPPORT IF DAMAGED. REPLACE THE PACKINGS ON THE SUPPORT AND ON ALL THE OIL TRANSFER TUBES.
8
REMOVE THE INLET CASE STRAINER ELEMENT (SEE INSPECTION/CHECK AND FIGURE 122).
IS OIL FOUND IN THE INLET CASE?
NO
YES
9
REMOVE THE INLET TUBE CONNECTOR AND EXAMINE THE TUBE SEALS AT THE BOTTOM OF THE INLET CASE. (SEE FIGURE 121).
ARE THE SEALS IN GOOD CONDITION?
YES
NO
10
REPLACE THE DAMAGED SEALS
11
REMOVE THE FRONT ACCESSORY SUPPORT (SEE SECTION 72-21-00, MAINTENANCE PRACTICES) AND EXAMINE THE NO. 1 BEARING OIL SCAVENGE PUMP FOR BLOCKAGE OR DAMAGE (SEE FIGURE 120).
IS THE PUMP IN GOOD CONDITION?
NO
12
REPLACE THE PUMP OR CLEAN THE PUMP STRAINER
YES
13
REMOVE THE ENGINE FOR REPAIR
L-H1352 (0102)

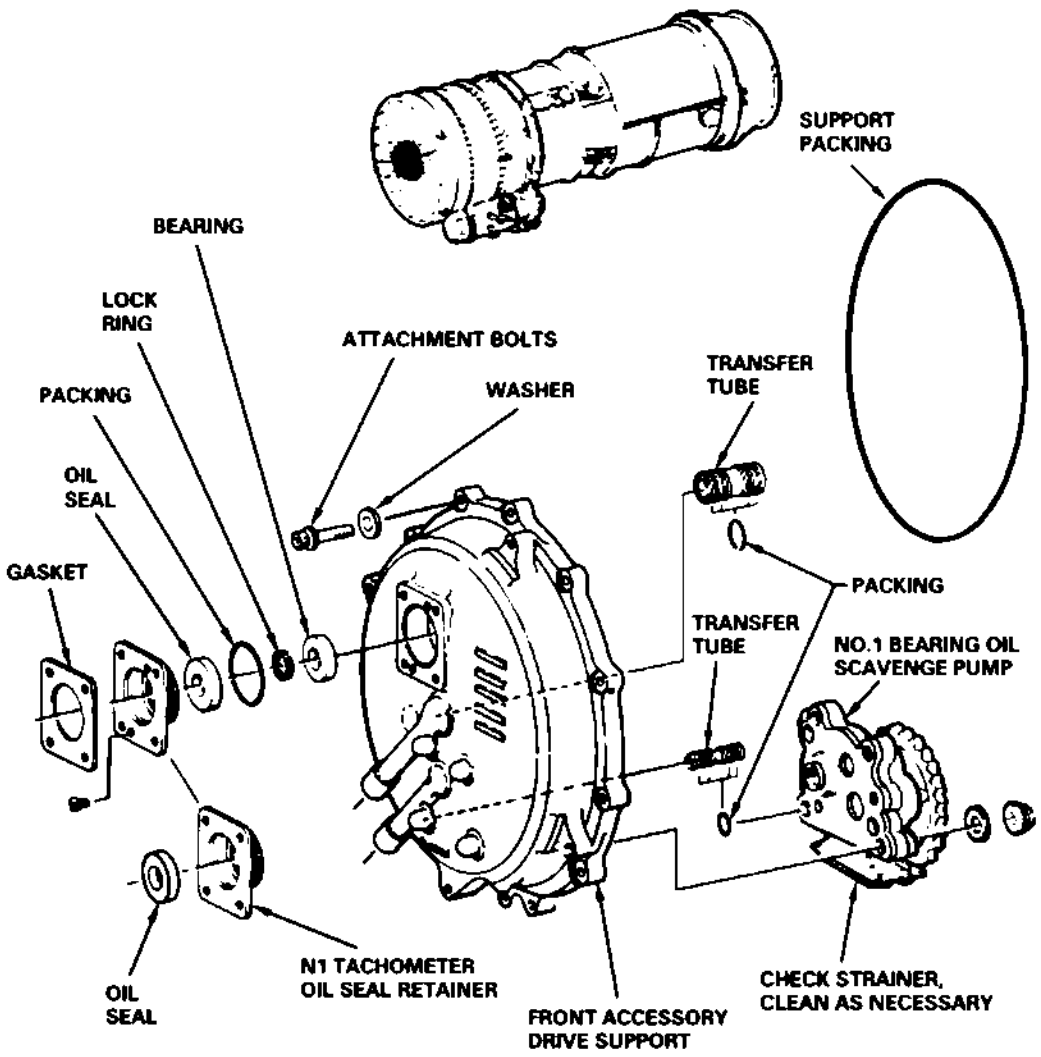
Oil Fumes In The
Cabin Troubleshooting
Figure 118 (Sheet 2)
(Task 72-00-00-810-004)



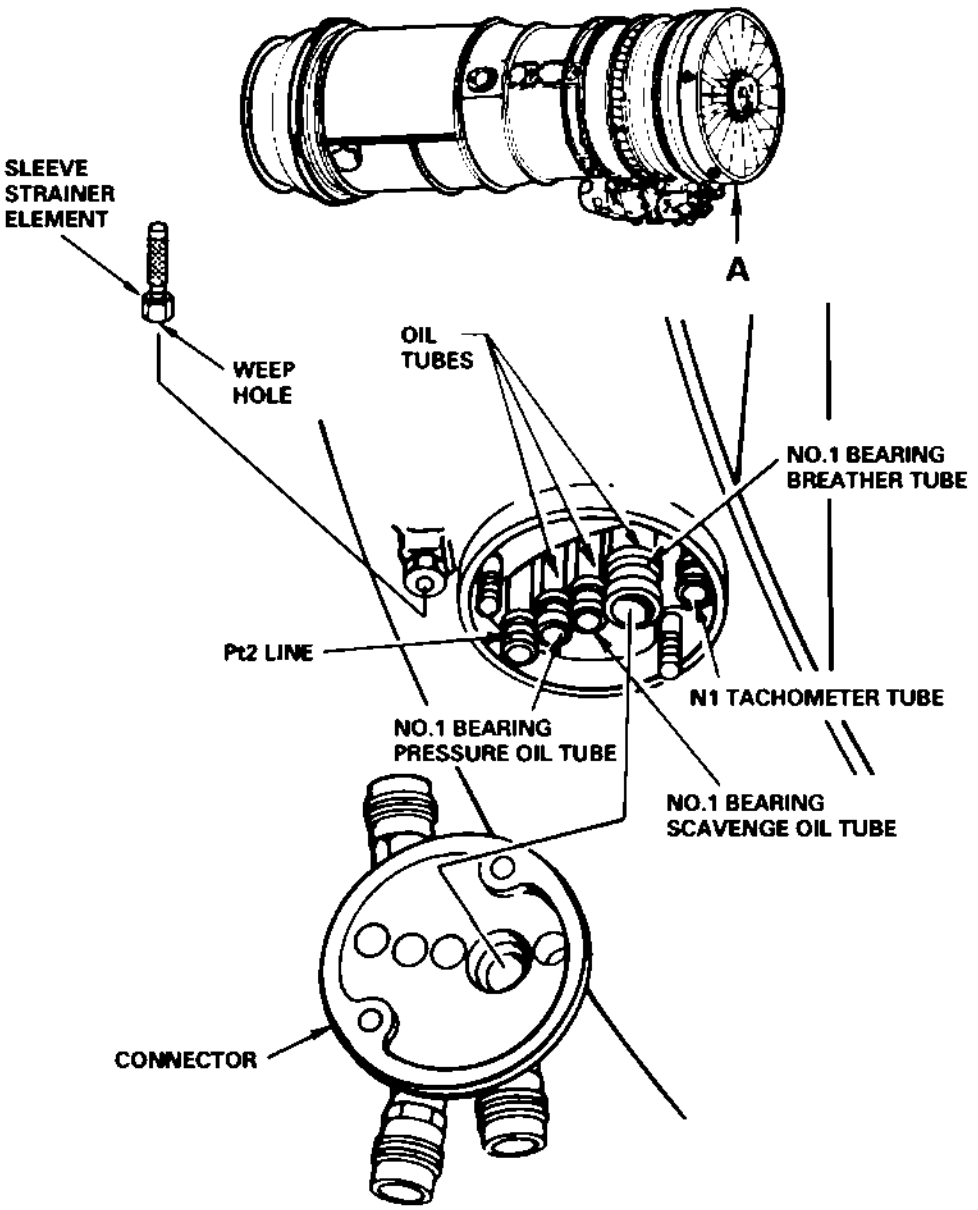
Engine Inlet Inspection
For Oil Leaks
Figure 119
(Task 72-00-00-810-004)



Inlet Dome And N1 Tachometer
Inspection For Oil Leaks
Figure 120
(Task 72-00-00-810-004)



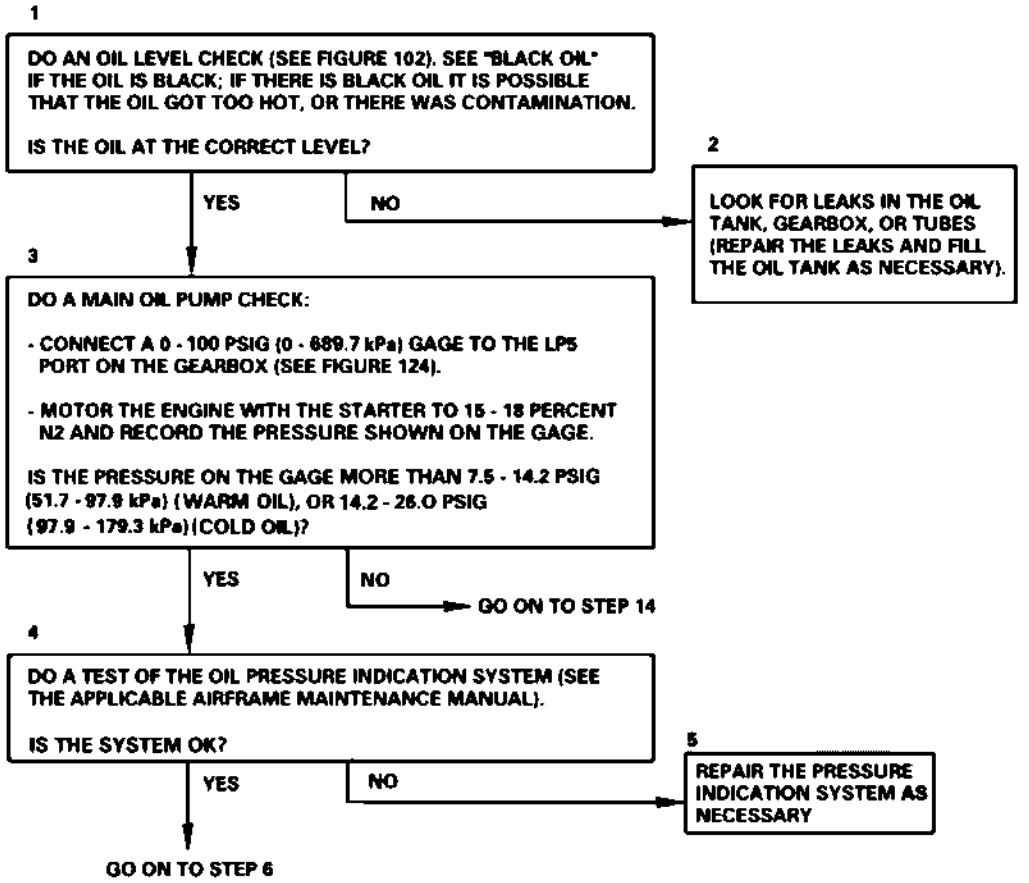
Front Accessory Drive Support
Inspection For Oil Leaks
Figure 121
(Task 72-00-00-810-004)



Inlet Case Connector And Strainer
Inspection For Oil Leaks
Figure 122
(Task 72-00-00-810-004)

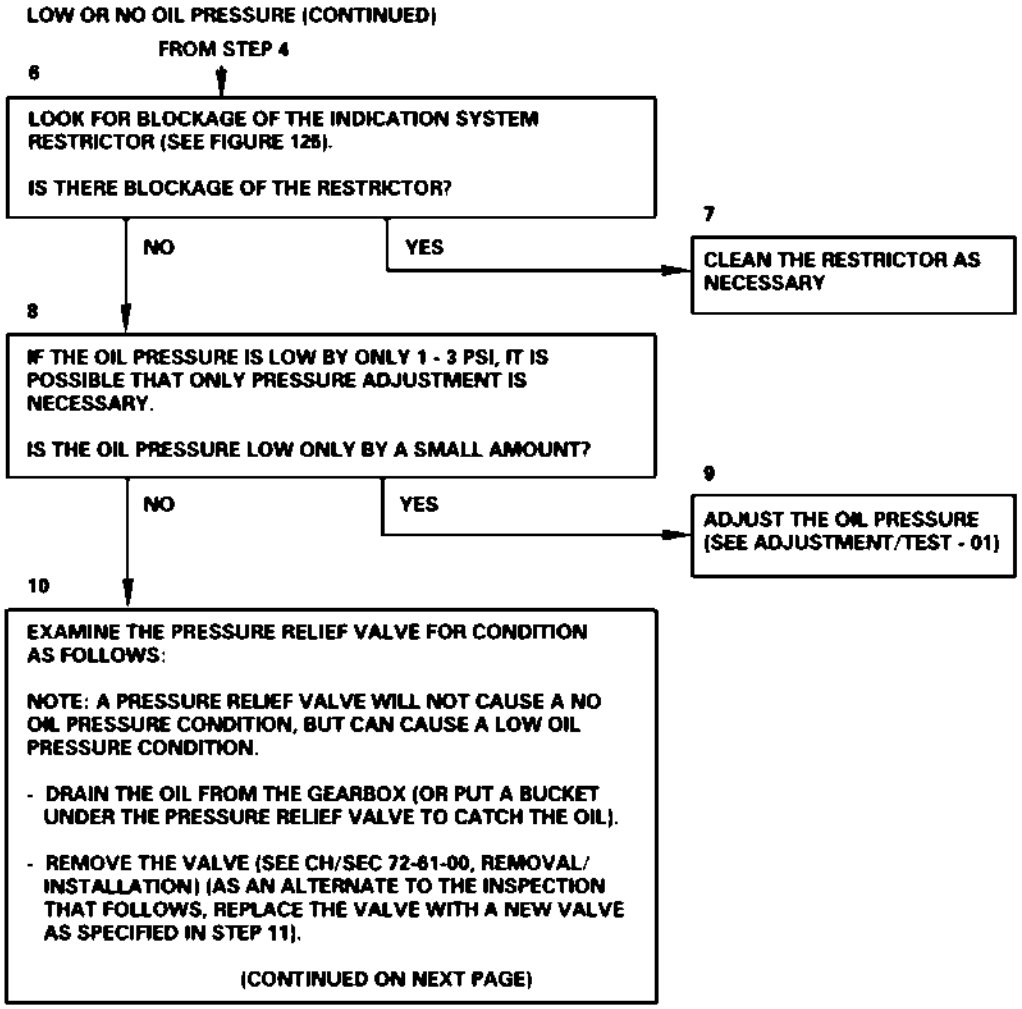
LOW OR NO OIL PRESSURE

NOTE: WHEN PARTS OR COMPONENTS ARE REPLACED TO CORRECT AN ENGINE PROBLEM, BE SURE TO DO THE NECESSARY TEST (SEE ADJUSTMENT/TEST-01, "REPAIR REFERENCE TABLE ") AFTER THE REPAIRS ARE COMPLETED.


1
DO AN OIL LEVEL CHECK (SEE FIGURE 102). SEE "BLACK OIL" IF THE OIL IS BLACK; IF THERE IS BLACK OIL IT IS POSSIBLE THAT THE OIL GOT TOO HOT, OR THERE WAS CONTAMINATION.
IS THE OIL AT THE CORRECT LEVEL?
YES
NO
2
LOOK FOR LEAKS IN THE OIL TANK, GEARBOX, OR TUBES (REPAIR THE LEAKS AND FILL THE OIL TANK AS NECESSARY).
3
DO A MAIN OIL PUMP CHECK:
- CONNECT A 0 - 100 PSIG (0 - 689.7 kPa) GAGE TO THE LP5 PORT ON THE GEARBOX (SEE FIGURE 124).
- MOTOR THE ENGINE WITH THE STARTER TO 15 - 18 PERCENT N2 AND RECORD THE PRESSURE SHOWN ON THE GAGE.
IS THE PRESSURE ON THE GAGE MORE THAN 7.5 - 14.2 PSIG (51.7 - 97.9 kPa) (WARM OIL), OR 14.2 - 26.0 PSIG (97.9 - 179.3 kPa) (COLD OIL)?
YES
NO
GO ON TO STEP 14
4
DO A TEST OF THE OIL PRESSURE INDICATION SYSTEM (SEE THE APPLICABLE AIRFRAME MAINTENANCE MANUAL).
IS THE SYSTEM OK?
YES
NO
5
REPAIR THE PRESSURE INDICATION SYSTEM AS NECESSARY
GO ON TO STEP 6

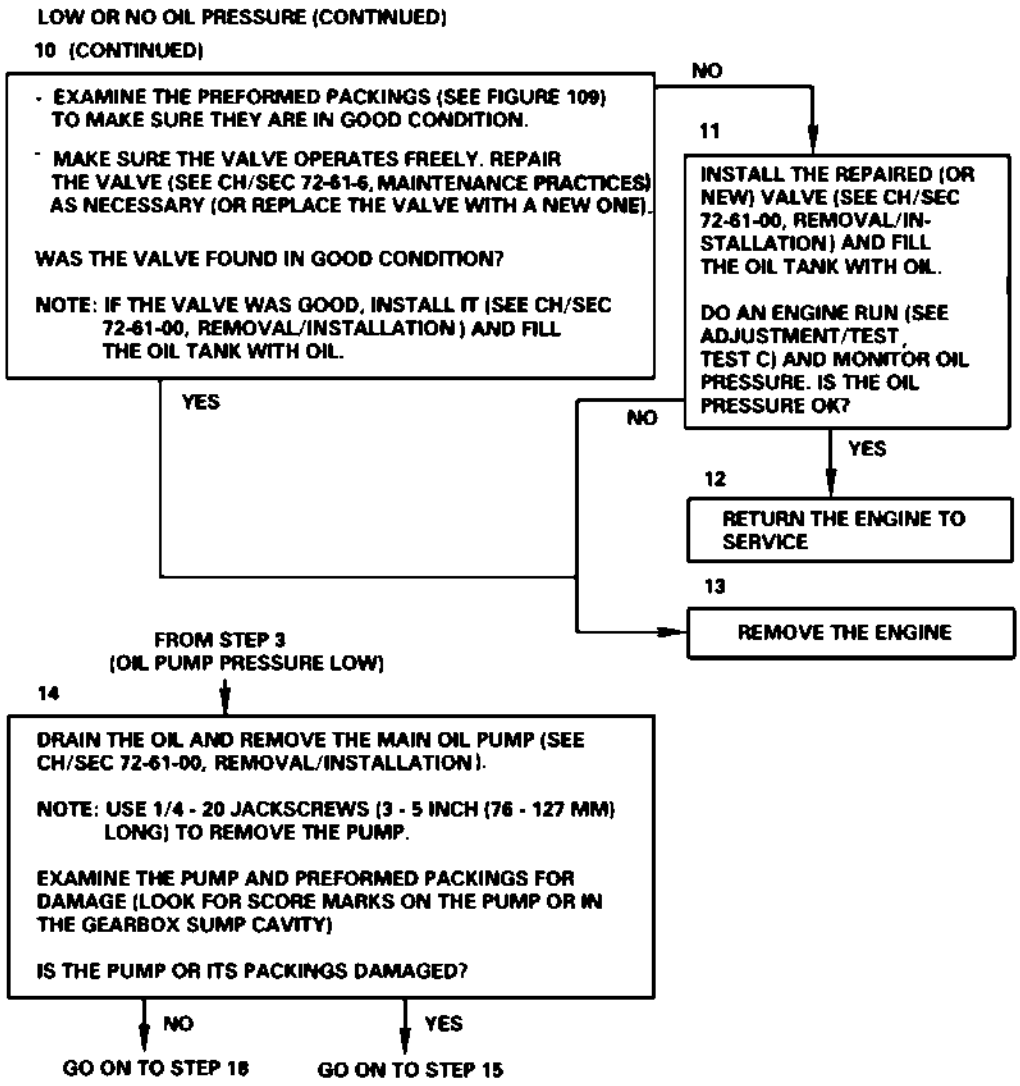
L-H1686 (0102)

No Or Low Oil Pressure
Troubleshooting
Figure 123 (Sheet 1)
(Task 72-00-00-810-004)


LOW OR NO OIL PRESSURE (CONTINUED)
FROM STEP 4
6
LOOK FOR BLOCKAGE OF THE INDICATION SYSTEM RESTRICTOR (SEE FIGURE 125).
IS THERE BLOCKAGE OF THE RESTRICTOR?
NO
YES
7
CLEAN THE RESTRICTOR AS NECESSARY
8
IF THE OIL PRESSURE IS LOW BY ONLY 1 - 3 PSI, IT IS POSSIBLE THAT ONLY PRESSURE ADJUSTMENT IS NECESSARY.
IS THE OIL PRESSURE LOW ONLY BY A SMALL AMOUNT?
NO
YES
9
ADJUST THE OIL PRESSURE (SEE ADJUSTMENT/TEST - 01)
10
EXAMINE THE PRESSURE RELIEF VALVE FOR CONDITION AS FOLLOWS:
NOTE: A PRESSURE RELIEF VALVE WILL NOT CAUSE A NO OIL PRESSURE CONDITION, BUT CAN CAUSE A LOW OIL PRESSURE CONDITION.
- DRAIN THE OIL FROM THE GEARBOX (OR PUT A BUCKET UNDER THE PRESSURE RELIEF VALVE TO CATCH THE OIL).
- REMOVE THE VALVE (SEE CH/SEC 72-61-00, REMOVAL/INSTALLATION) (AS AN ALTERNATE TO THE INSPECTION THAT FOLLOWS, REPLACE THE VALVE WITH A NEW VALVE AS SPECIFIED IN STEP 11).
(CONTINUED ON NEXT PAGE)

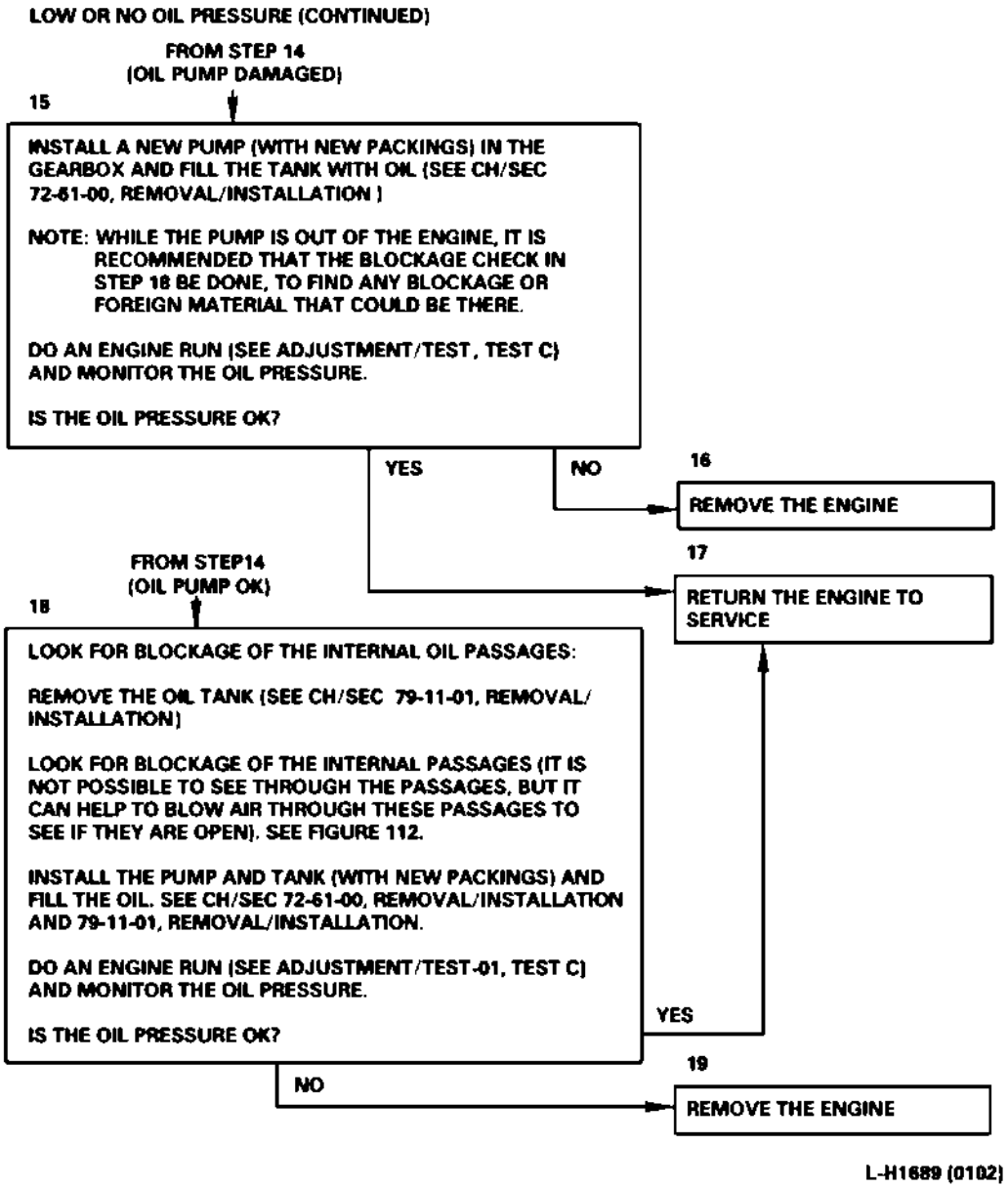
L-H1687 (0102)

No Or Low Oil Pressure
Troubleshooting
Figure 123 (Sheet 2)
(Task 72-00-00-810-004)

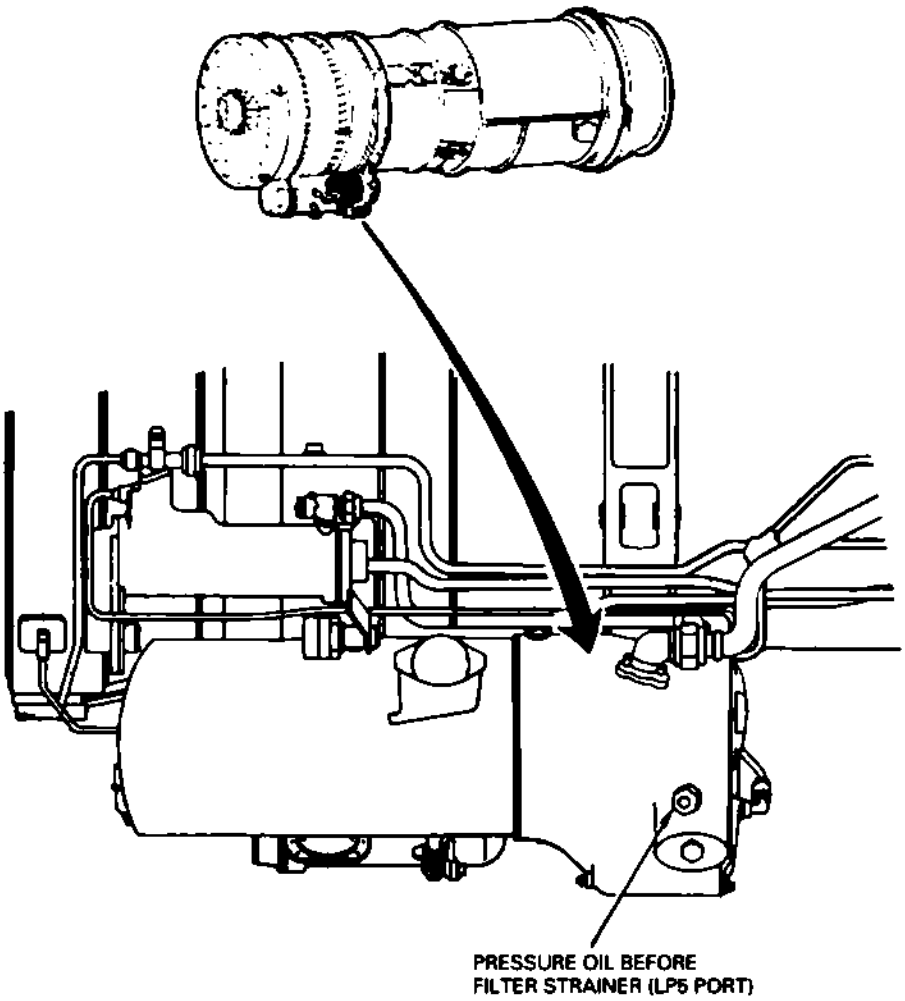

LOW OR NO OIL PRESSURE (CONTINUED)
10 (CONTINUED)
- EXAMINE THE PREFORMED PACKINGS (SEE FIGURE 109) TO MAKE SURE THEY ARE IN GOOD CONDITION.
- MAKE SURE THE VALVE OPERATES FREELY. REPAIR THE VALVE (SEE CH/SEC 72-61-6, MAINTENANCE PRACTICES) AS NECESSARY (OR REPLACE THE VALVE WITH A NEW ONE).
WAS THE VALVE FOUND IN GOOD CONDITION?
NOTE: IF THE VALVE WAS GOOD, INSTALL IT (SEE CH/SEC 72-61-00, REMOVAL/INSTALLATION) AND FILL THE OIL TANK WITH OIL.
NO
11
INSTALL THE REPAIRED (OR NEW) VALVE (SEE CH/SEC 72-61-00, REMOVAL/INSTALLATION) AND FILL THE OIL TANK WITH OIL.
DO AN ENGINE RUN (SEE ADJUSTMENT/TEST, TEST C) AND MONITOR OIL PRESSURE. IS THE OIL PRESSURE OK?
YES
NO
12
RETURN THE ENGINE TO SERVICE
13
REMOVE THE ENGINE
FROM STEP 3
(OIL PUMP PRESSURE LOW)
14
DRAIN THE OIL AND REMOVE THE MAIN OIL PUMP (SEE CH/SEC 72-61-00, REMOVAL/INSTALLATION).
NOTE: USE 1/4 - 20 JACKSCREWS (3 - 5 INCH (76 - 127 MM) LONG) TO REMOVE THE PUMP.
EXAMINE THE PUMP AND PREFORMED PACKINGS FOR DAMAGE (LOOK FOR SCORE MARKS ON THE PUMP OR IN THE GEARBOX SUMP CAVITY)
IS THE PUMP OR ITS PACKINGS DAMAGED?
NO
GO ON TO STEP 16
YES
GO ON TO STEP 15

L-H1688 (0102)

No Or Low Oil Pressure
Troubleshooting
Figure 123 (Sheet 3)
(Task 72-00-00-810-004)

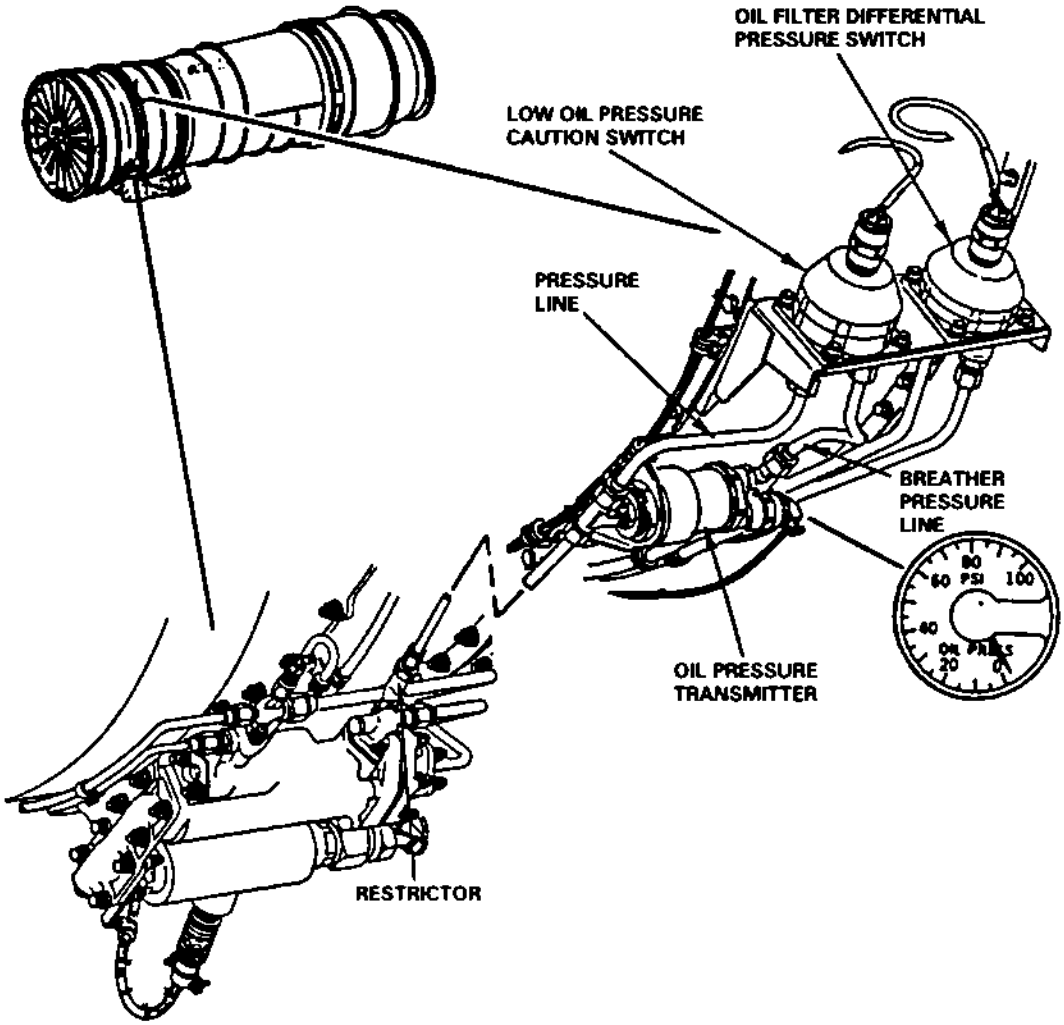

LOW OR NO OIL PRESSURE (CONTINUED)
FROM STEP 14
(OIL PUMP DAMAGED)
15
INSTALL A NEW PUMP (WITH NEW PACKINGS) IN THE GEARBOX AND FILL THE TANK WITH OIL (SEE CH/SEC 72-61-00, REMOVAL/INSTALLATION)
NOTE: WHILE THE PUMP IS OUT OF THE ENGINE, IT IS RECOMMENDED THAT THE BLOCKAGE CHECK IN STEP 18 BE DONE, TO FIND ANY BLOCKAGE OR FOREIGN MATERIAL THAT COULD BE THERE.
DO AN ENGINE RUN (SEE ADJUSTMENT/TEST, TEST C) AND MONITOR THE OIL PRESSURE.
IS THE OIL PRESSURE OK?
YES
NO
16
REMOVE THE ENGINE
17
RETURN THE ENGINE TO SERVICE
FROM STEP14
(OIL PUMP OK)
18
LOOK FOR BLOCKAGE OF THE INTERNAL OIL PASSAGES:
REMOVE THE OIL TANK (SEE CH/SEC 79-11-01, REMOVAL/INSTALLATION)
LOOK FOR BLOCKAGE OF THE INTERNAL PASSAGES (IT IS NOT POSSIBLE TO SEE THROUGH THE PASSAGES, BUT IT CAN HELP TO BLOW AIR THROUGH THESE PASSAGES TO SEE IF THEY ARE OPEN). SEE FIGURE 112.
INSTALL THE PUMP AND TANK (WITH NEW PACKINGS) AND FILL THE OIL. SEE CH/SEC 72-61-00, REMOVAL/INSTALLATION AND 79-11-01, REMOVAL/INSTALLATION.
DO AN ENGINE RUN (SEE ADJUSTMENT/TEST-01, TEST C) AND MONITOR THE OIL PRESSURE.
IS THE OIL PRESSURE OK?
YES
NO
19
REMOVE THE ENGINE
L-H1689 (0102)

No Or Low Oil Pressure
Troubleshooting
Figure 123 (Sheet 4)
(Task 72-00-00-810-004)

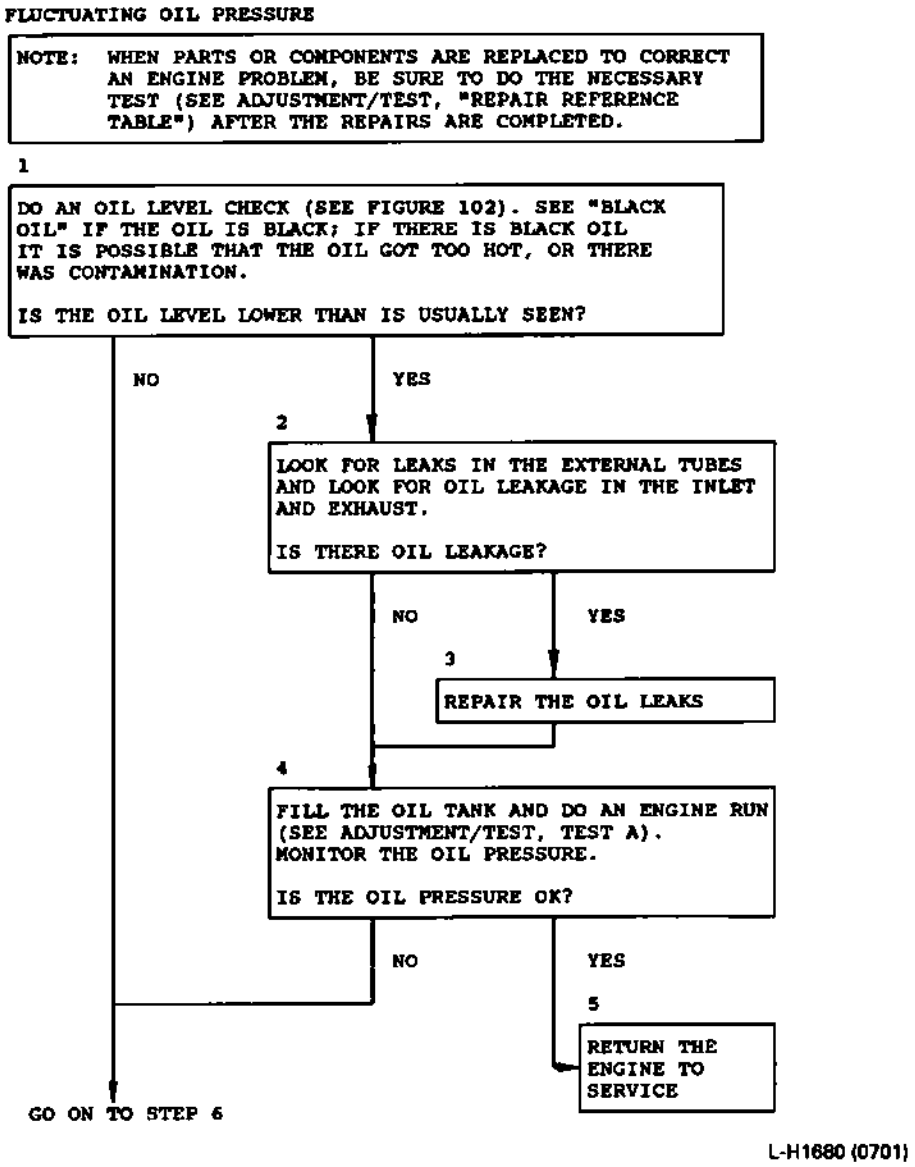


L-56811 (0100)

Main Oil Pump Operation Check
Figure 124
(Task 72-00-00-810-004)

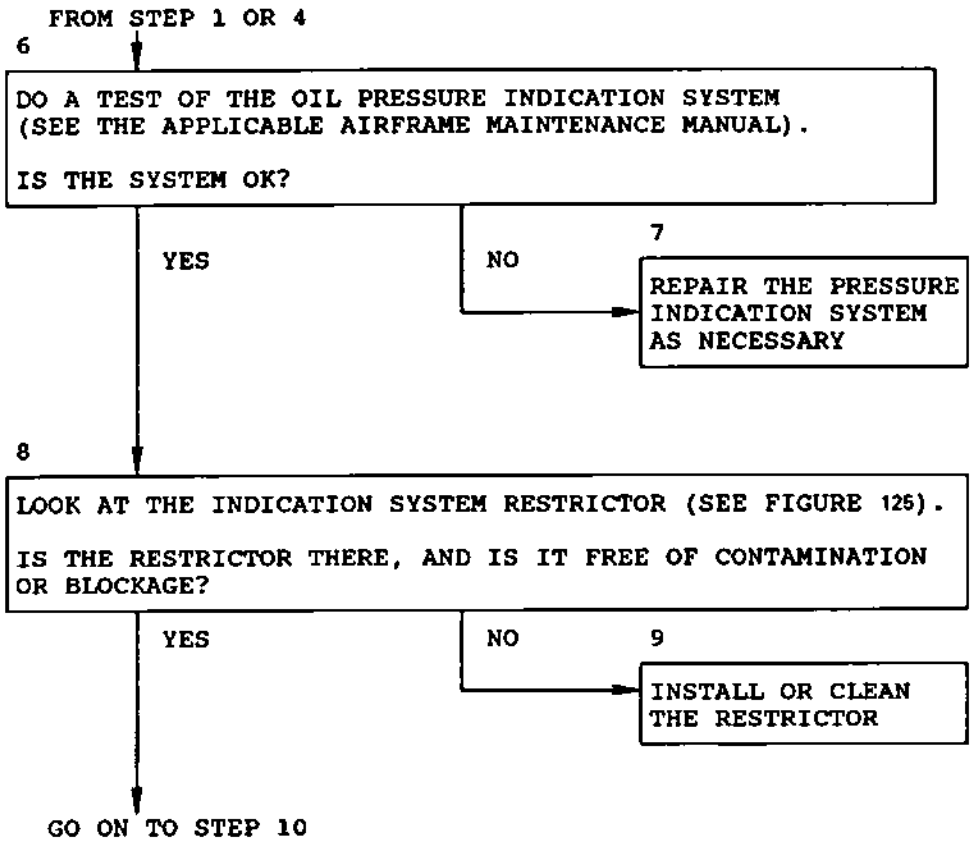


Powerplant Oil Pressure
Indicating System
Figure 125
(Task 72-00-00-810-004)


FLUCTUATING OIL PRESSURE
NOTE: WHEN PARTS OR COMPONENTS ARE REPLACED TO CORRECT AN ENGINE PROBLEM, BE SURE TO DO THE NECESSARY TEST (SEE ADJUSTMENT/TEST, "REPAIR REFERENCE TABLE") AFTER THE REPAIRS ARE COMPLETED.
1
DO AN OIL LEVEL CHECK (SEE FIGURE 102). SEE "BLACK OIL" IF THE OIL IS BLACK; IF THERE IS BLACK OIL IT IS POSSIBLE THAT THE OIL GOT TOO HOT, OR THERE WAS CONTAMINATION.
IS THE OIL LEVEL LOWER THAN IS USUALLY SEEN?
NO
YES
2
LOOK FOR LEAKS IN THE EXTERNAL TUBES AND LOOK FOR OIL LEAKAGE IN THE INLET AND EXHAUST.
IS THERE OIL LEAKAGE?
NO
YES
3
REPAIR THE OIL LEAKS
4
FILL THE OIL TANK AND DO AN ENGINE RUN (SEE ADJUSTMENT/TEST, TEST A). MONITOR THE OIL PRESSURE.
IS THE OIL PRESSURE OK?
NO
YES
5
RETURN THE ENGINE TO SERVICE
GO ON TO STEP 6
L-H1680 (0701)

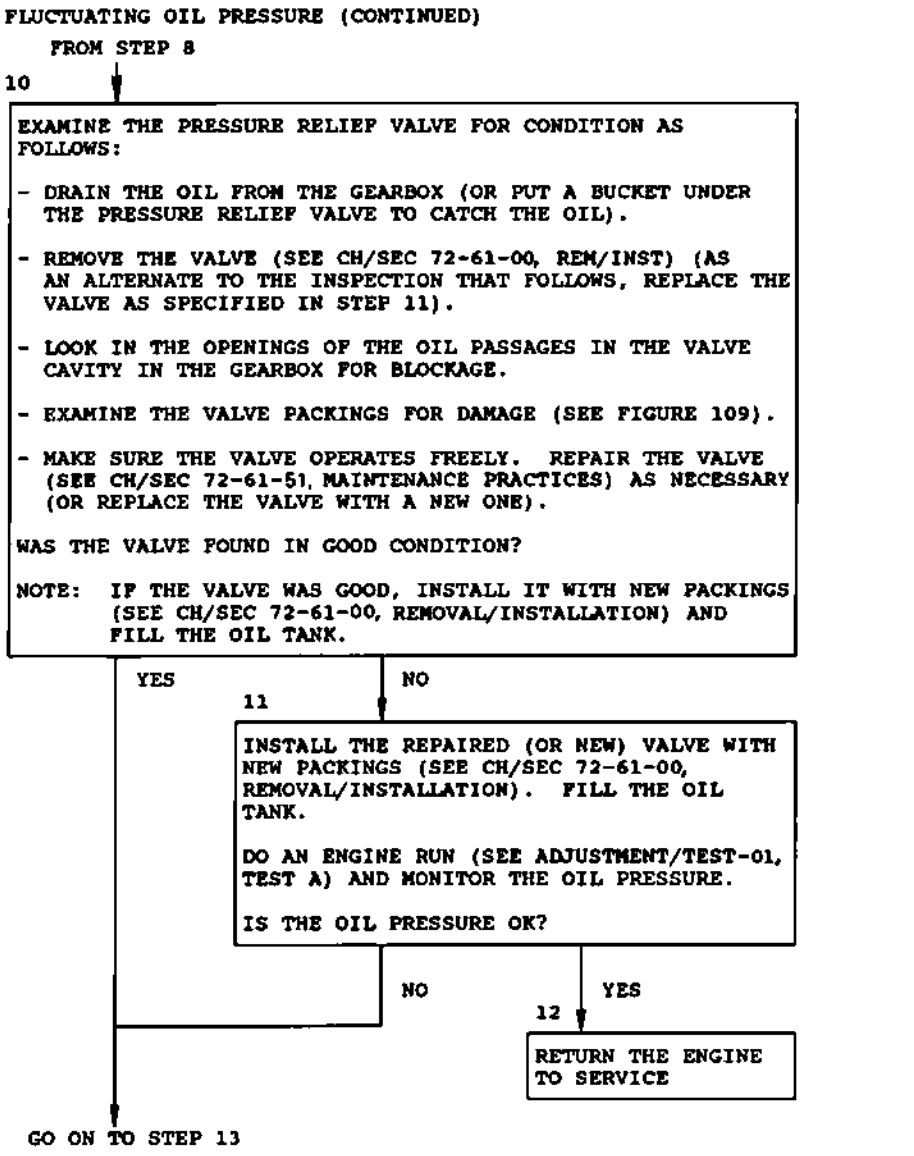
Fluctuating Oil Pressure
Troubleshooting
Figure 126 (Sheet 1)
(Task 72-00-00-810-004)

FLUCTUATING OIL PRESSURE (CONTINUED)


FROM STEP 1 OR 4
6
DO A TEST OF THE OIL PRESSURE INDICATION SYSTEM (SEE THE APPLICABLE AIRFRAME MAINTENANCE MANUAL).
IS THE SYSTEM OK?
YES
NO
7
REPAIR THE PRESSURE INDICATION SYSTEM AS NECESSARY
8
LOOK AT THE INDICATION SYSTEM RESTRICTOR (SEE FIGURE 125).
IS THE RESTRICTOR THERE, AND IS IT FREE OF CONTAMINATION OR BLOCKAGE?
YES
NO
9
INSTALL OR CLEAN THE RESTRICTOR
GO ON TO STEP 10

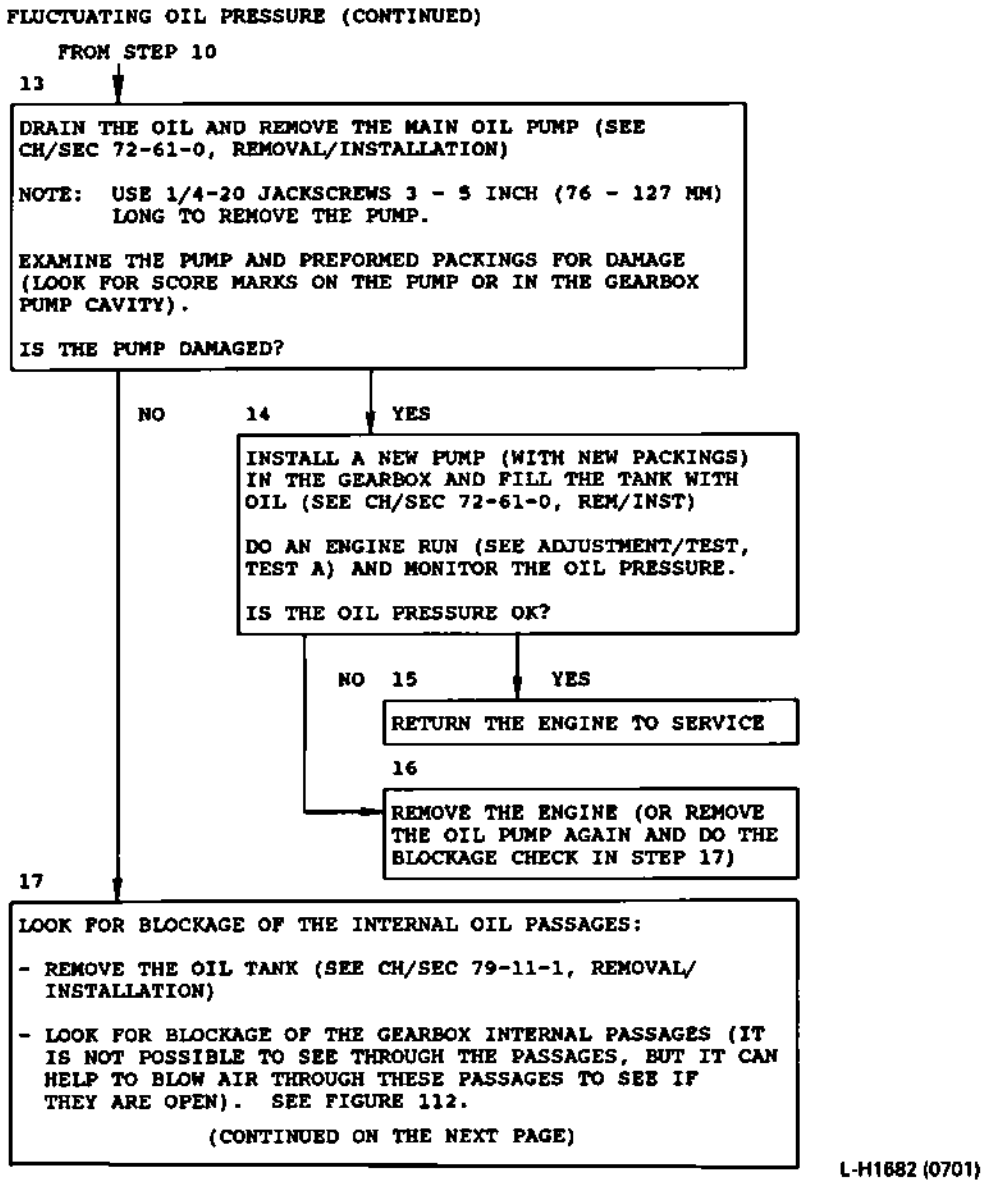
L-H1673 (0701)

Fluctuating Oil Pressure
Troubleshooting
Figure 126 (Sheet 2)
(Task 72-00-00-810-004)


FLUCTUATING OIL PRESSURE (CONTINUED)
FROM STEP 8
10
EXAMINE THE PRESSURE RELIEF VALVE FOR CONDITION AS FOLLOWS:
- DRAIN THE OIL FROM THE GEARBOX (OR PUT A BUCKET UNDER THE PRESSURE RELIEF VALVE TO CATCH THE OIL).
- REMOVE THE VALVE (SEE CH/SEC 72-61-00, REM/INST) (AS AN ALTERNATE TO THE INSPECTION THAT FOLLOWS, REPLACE THE VALVE AS SPECIFIED IN STEP 11).
- LOOK IN THE OPENINGS OF THE OIL PASSAGES IN THE VALVE CAVITY IN THE GEARBOX FOR BLOCKAGE.
- EXAMINE THE VALVE PACKINGS FOR DAMAGE (SEE FIGURE 109).
- MAKE SURE THE VALVE OPERATES FREELY. REPAIR THE VALVE (SEE CH/SEC 72-61-51, MAINTENANCE PRACTICES) AS NECESSARY (OR REPLACE THE VALVE WITH A NEW ONE).
WAS THE VALVE FOUND IN GOOD CONDITION?
NOTE: IF THE VALVE WAS GOOD, INSTALL IT WITH NEW PACKINGS (SEE CH/SEC 72-61-00, REMOVAL/INSTALLATION) AND FILL THE OIL TANK.
YES
NO
11
INSTALL THE REPAIRED (OR NEW) VALVE WITH NEW PACKINGS (SEE CH/SEC 72-61-00, REMOVAL/INSTALLATION). FILL THE OIL TANK.
DO AN ENGINE RUN (SEE ADJUSTMENT/TEST-01, TEST A) AND MONITOR THE OIL PRESSURE.
IS THE OIL PRESSURE OK?
NO
YES
12
RETURN THE ENGINE TO SERVICE
GO ON TO STEP 13

L-H1681 (0102)

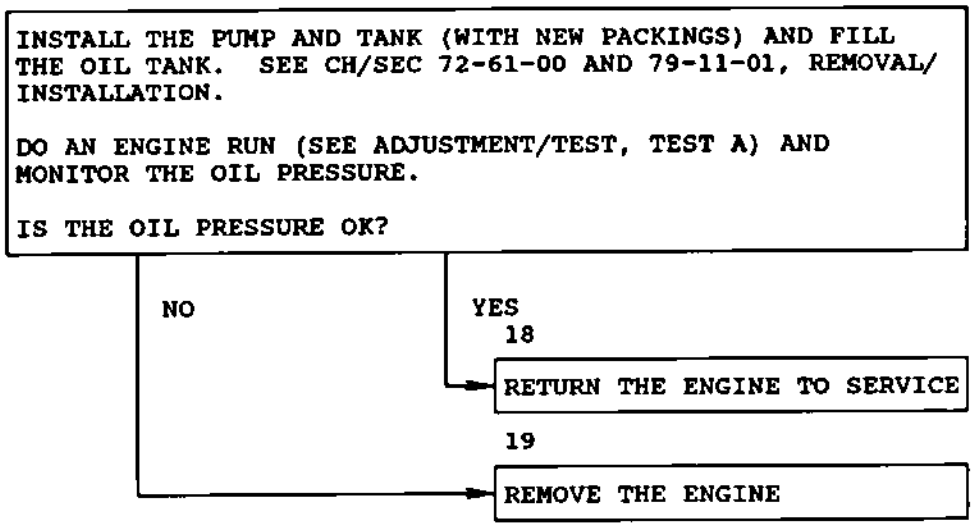
Fluctuating Oil Pressure
Troubleshooting
Figure 126 (Sheet 3)
(Task 72-00-00-810-004)


FLUCTUATING OIL PRESSURE (CONTINUED)
FROM STEP 10
13
DRAIN THE OIL AND REMOVE THE MAIN OIL PUMP (SEE CH/SEC 72-61-0, REMOVAL/INSTALLATION)
NOTE: USE 1/4-20 JACKSCREWS 3 - 5 INCH (76 - 127 MM) LONG TO REMOVE THE PUMP.
EXAMINE THE PUMP AND PREFORMED PACKINGS FOR DAMAGE (LOOK FOR SCORE MARKS ON THE PUMP OR IN THE GEARBOX PUMP CAVITY).
IS THE PUMP DAMAGED?
NO
14
YES
INSTALL A NEW PUMP (WITH NEW PACKINGS) IN THE GEARBOX AND FILL THE TANK WITH OIL (SEE CH/SEC 72-61-0, REM/INST)
DO AN ENGINE RUN (SEE ADJUSTMENT/TEST, TEST A) AND MONITOR THE OIL PRESSURE.
IS THE OIL PRESSURE OK?
NO
15
YES
RETURN THE ENGINE TO SERVICE
16
REMOVE THE ENGINE (OR REMOVE THE OIL PUMP AGAIN AND DO THE BLOCKAGE CHECK IN STEP 17)
17
LOOK FOR BLOCKAGE OF THE INTERNAL OIL PASSAGES:
- REMOVE THE OIL TANK (SEE CH/SEC 79-11-1, REMOVAL/ INSTALLATION)
- LOOK FOR BLOCKAGE OF THE GEARBOX INTERNAL PASSAGES (IT IS NOT POSSIBLE TO SEE THROUGH THE PASSAGES, BUT IT CAN HELP TO BLOW AIR THROUGH THESE PASSAGES TO SEE IF THEY ARE OPEN). SEE FIGURE 112.
(CONTINUED ON THE NEXT PAGE)
L-H1682 (0701)

Fluctuating Oil Pressure
Troubleshooting
Figure 126 (Sheet 4)
(Task 72-00-00-810-004)

FLUCTUATING OIL PRESSURE (CONTINUED)

17 (CONTINUED)


INSTALL THE PUMP AND TANK (WITH NEW PACKINGS) AND FILL THE OIL TANK. SEE CH/SEC 72-61-00 AND 79-11-01, REMOVAL/ INSTALLATION.
DO AN ENGINE RUN (SEE ADJUSTMENT/TEST, TEST A) AND MONITOR THE OIL PRESSURE.
IS THE OIL PRESSURE OK?
NO
YES
18
RETURN THE ENGINE TO SERVICE
19
REMOVE THE ENGINE

L-H1683 (0102)

Fluctuating Oil Pressure
Troubleshooting
Figure 126 (Sheet 5)
(Task 72-00-00-810-004)

OIL PRESSURE FOLLOWS THE POWER LEVER

NOTE: WHEN PARTS OR COMPONENTS ARE REPLACED TO CORRECT AN ENGINE PROBLEM, BE SURE TO DO THE NECESSARY TEST (SEE ADJUSTMENT/TEST, "REPAIR REFERENCE TABLE") AFTER THE REPAIRS ARE COMPLETED.

1

EXAMINE THE PRESSURE RELIEF VALVE FOR CONDITION AS FOLLOWS:

- DRAIN THE OIL FROM THE GEARBOX (OR PUT A BUCKET UNDER THE PRESSURE RELIEF VALVE TO CATCH THE OIL).
- REMOVE THE VALVE (SEE CH/SEC 72-61-00, REM/INST) (AS AN ALTERNATE TO THE INSPECTION THAT FOLLOWS, REPLACE THE VALVE AS SPECIFIED IN STEP 2).
- LOOK IN THE OPENINGS OF THE OIL PASSAGES IN THE VALVE CAVITY IN THE GEARBOX FOR BLOCKAGE.
- EXAMINE THE PACKINGS FOR DAMAGE (SEE FIGURE 111).
- MAKE SURE THE VALVE OPERATES FREELY. REPAIR THE VALVE (SEE CH/SEC 72-61-51, MAINTENANCE PRACTICES) AS NECESSARY (OR REPLACE THE VALVE WITH A NEW ONE).

WAS THE VALVE FOUND IN GOOD CONDITION?

NOTE: IF THE VALVE WAS GOOD, INSTALL IT WITH NEW PACKINGS (SEE CH/SEC 72-61-00, REMOVAL/INSTALLATION) AND FILL THE OIL TANK.

YES

NO

2

INSTALL THE REPAIRED (OR NEW) VALVE WITH NEW PACKINGS (SEE CH/SEC 72-61-00, REMOVAL/INSTALLATION). FILL THE OIL TANK.

DO AN ENGINE RUN (SEE ADJUSTMENT/TEST, TEST A) AND MONITOR THE OIL PRESSURE.

IS THE OIL PRESSURE OK?

NO

3

YES

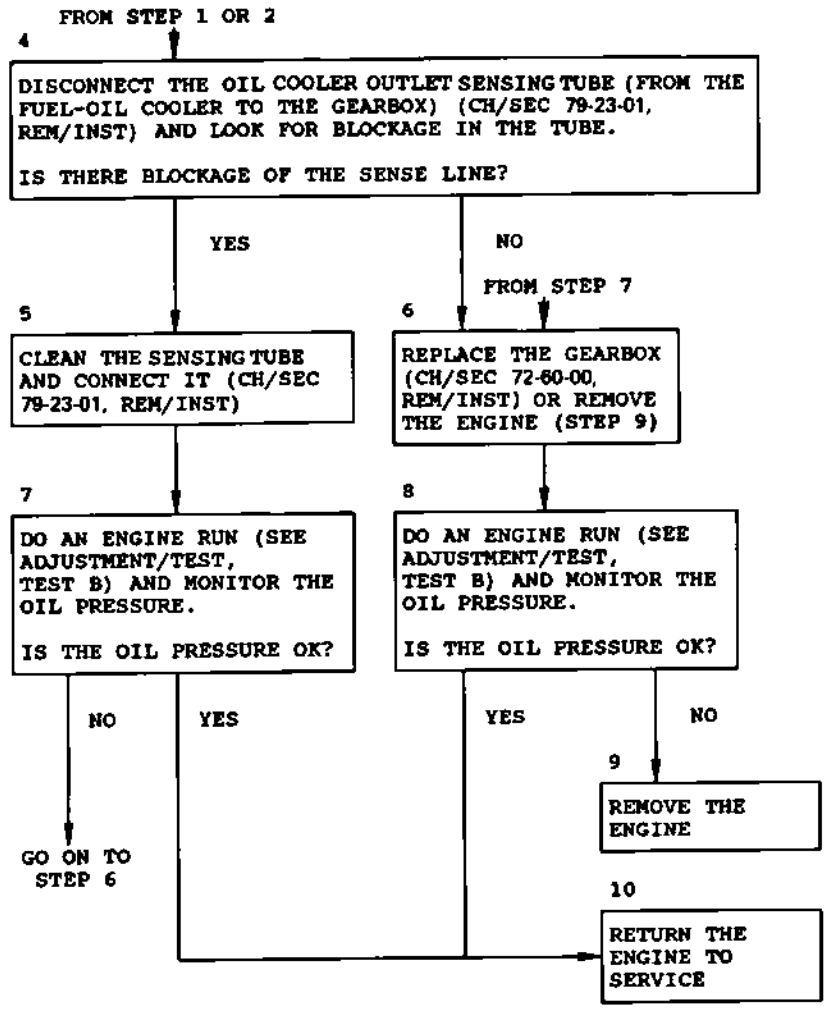
RETURN THE ENGINE TO SERVICE

GO ON TO STEP 4

L-H1684 (0102)

Oil Pressure Follows The
Power Lever Troubleshooting
Figure 127 (Sheet 1)
(Task 72-00-00-810-004)

OIL PRESSURE FOLLOWS POWER LEVER (CONTINUED)


FROM STEP 1 OR 2
4
DISCONNECT THE OIL COOLER OUTLET SENSING TUBE (FROM THE FUEL-OIL COOLER TO THE GEARBOX) (CH/SEC 79-23-01, REM/INST) AND LOOK FOR BLOCKAGE IN THE TUBE.
IS THERE BLOCKAGE OF THE SENSE LINE?
YES
NO
FROM STEP 7
5
CLEAN THE SENSING TUBE AND CONNECT IT (CH/SEC 79-23-01, REM/INST)
6
REPLACE THE GEARBOX (CH/SEC 72-60-00, REM/INST) OR REMOVE THE ENGINE (STEP 9)
7
DO AN ENGINE RUN (SEE ADJUSTMENT/TEST, TEST B) AND MONITOR THE OIL PRESSURE.
IS THE OIL PRESSURE OK?
8
DO AN ENGINE RUN (SEE ADJUSTMENT/TEST, TEST B) AND MONITOR THE OIL PRESSURE.
IS THE OIL PRESSURE OK?
NO
YES
YES
NO
GO ON TO STEP 6
9
REMOVE THE ENGINE
10
RETURN THE ENGINE TO SERVICE

L-H1685 (0605)

Oil Pressure Follows The
Power Lever Troubleshooting
Figure 127 (Sheet 2)
(Task 72-00-00-810-004)

HIGH OIL PRESSURE

NOTE: WHEN PARTS OR COMPONENTS ARE REPLACED TO CORRECT AN ENGINE PROBLEM, BE SURE TO DO THE NECESSARY TEST (SEE ADJUSTMENT/TEST, "REPAIR REFERENCE TABLE") AFTER THE REPAIRS ARE COMPLETED.

1

DO A TEST OF THE OIL PRESSURE INDICATION SYSTEM (SEE THE APPLICABLE AIRFRAME DATA).

IS THE SYSTEM OK?

YES

NO

2

REPAIR THE PRESSURE INDICATION SYSTEM AS NECESSARY

3

EXAMINE THE PRESSURE RELIEF VALVE FOR CONDITION AS FOLLOWS:

- DRAIN THE OIL FROM THE GEARBOX (OR PUT A BUCKET UNDER THE PRESSURE RELIEF VALVE TO CATCH THE OIL).
- REMOVE THE VALVE (SEE CH/SEC 72-61-0, REM/INST) (AS AN ALTERNATE TO THE INSPECTION THAT FOLLOWS, REPLACE THE VALVE AS SPECIFIED IN STEP 4).
- LOOK IN THE OPENINGS OF THE OIL PASSAGES IN THE VALVE CAVITY IN THE GEARBOX FOR BLOCKAGE.
- EXAMINE THE VALVE PACKINGS FOR DAMAGE (SEE FIGURE 111).
- MAKE SURE THE VALVE OPERATES FREELY. REPAIR THE VALVE (SEE CH/SEC 72-61-51, MAINTENANCE PRACTICES) AS NECESSARY (OR REPLACE THE VALVE WITH A NEW ONE).

WAS THE VALVE FOUND IN GOOD CONDITION?

NOTE: IF THE VALVE WAS GOOD, INSTALL IT WITH NEW PACKINGS (SEE CH/SEC 72-61-00, REMOVAL/INSTALLATION) AND FILL THE OIL TANK.

YES

GO ON TO STEP 6

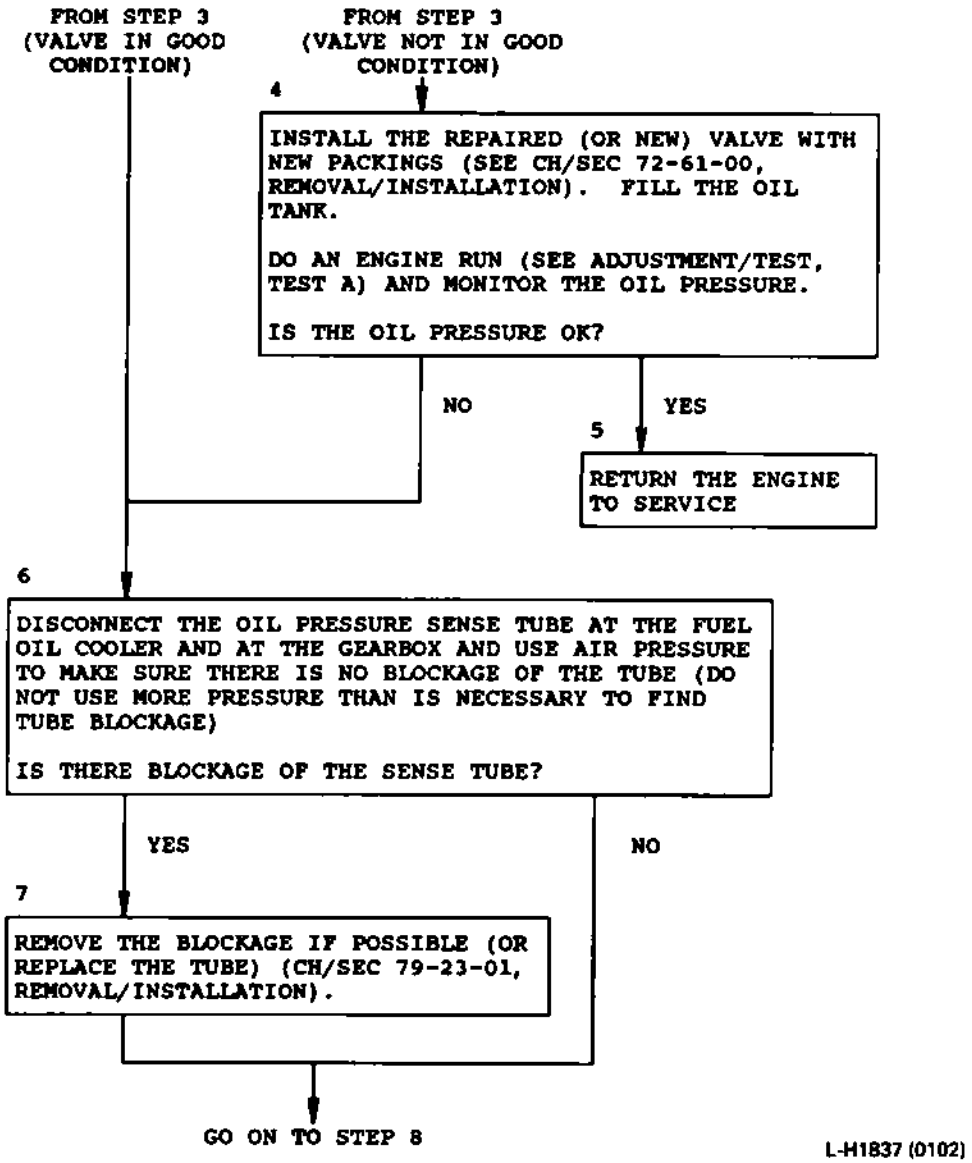
NO

GO ON TO STEP 4

L-H1470 (0102)

High Oil Pressure Troubleshooting
Figure 128 (Sheet 1)
(Task 72-00-00-810-004)

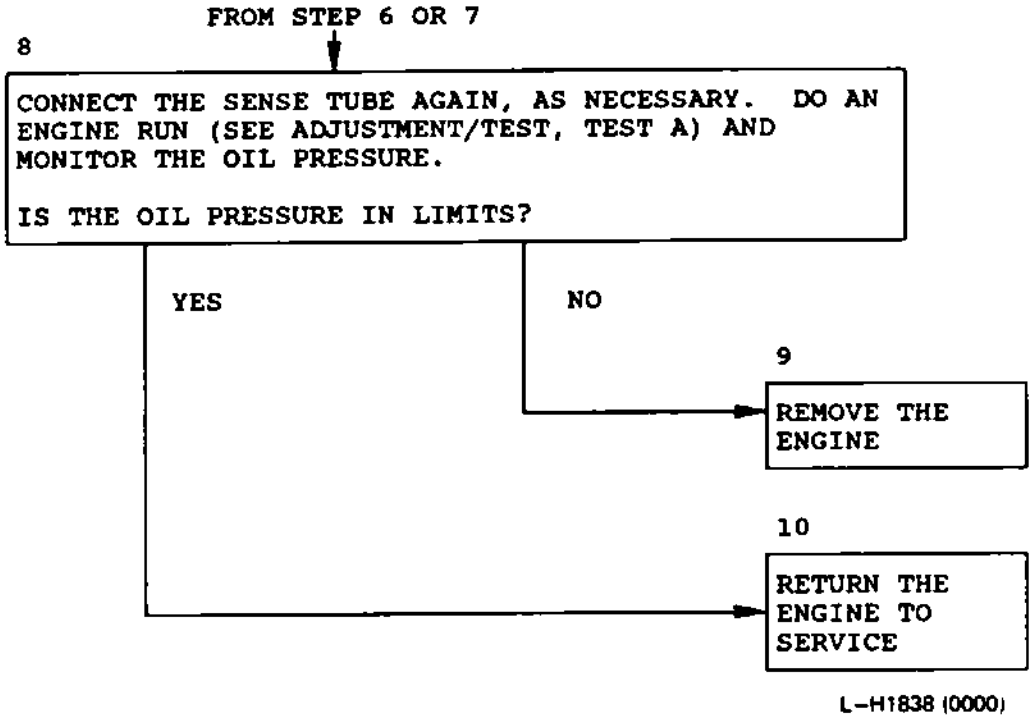
HIGH OIL PRESSURE (CONTINUED)


FROM STEP 3 (VALVE IN GOOD CONDITION)
FROM STEP 3 (VALVE NOT IN GOOD CONDITION)
4
INSTALL THE REPAIRED (OR NEW) VALVE WITH NEW PACKINGS (SEE CH/SEC 72-61-00, REMOVAL/INSTALLATION). FILL THE OIL TANK.
DO AN ENGINE RUN (SEE ADJUSTMENT/TEST, TEST A) AND MONITOR THE OIL PRESSURE.
IS THE OIL PRESSURE OK?
NO
YES
5
RETURN THE ENGINE TO SERVICE
6
DISCONNECT THE OIL PRESSURE SENSE TUBE AT THE FUEL OIL COOLER AND AT THE GEARBOX AND USE AIR PRESSURE TO MAKE SURE THERE IS NO BLOCKAGE OF THE TUBE (DO NOT USE MORE PRESSURE THAN IS NECESSARY TO FIND TUBE BLOCKAGE)
IS THERE BLOCKAGE OF THE SENSE TUBE?
YES
NO
7
REMOVE THE BLOCKAGE IF POSSIBLE (OR REPLACE THE TUBE) (CH/SEC 79-23-01, REMOVAL/INSTALLATION).
GO ON TO STEP 8

L-H1837 (0102)

High Oil Pressure Troubleshooting
Figure 128 (Sheet 2)
(Task 72-00-00-810-004)

HIGH OIL PRESSURE (CONTINUED)


FROM STEP 6 OR 7
8
CONNECT THE SENSE TUBE AGAIN, AS NECESSARY. DO AN ENGINE RUN (SEE ADJUSTMENT/TEST, TEST A) AND MONITOR THE OIL PRESSURE.
IS THE OIL PRESSURE IN LIMITS?
YES
NO
9
REMOVE THE ENGINE
10
RETURN THE ENGINE TO SERVICE
L-H1838 (0000)

High Oil Pressure Troubleshooting
Figure 128 (Sheet 3)
(Task 72-00-00-810-004)

Task 72-00-00-810-005:

1. Indication System - Diagrams

A. General

NOTE: This troubleshooting section is as follows:

Symptom	Paragraph
EPR System	B
EGT System	C

B. EPR System

(1) General

(a) This troubleshooting section is about different EPR complaints:

1 That the EPR indication alone is not stable at a given power level

2 That the EPR indication moves up and down with other engine parameters, and

3 That the EPR indication is low or high in relation to other engine parameters.

(b) EPR is the result of the division of Pt7 by Pt2. This measurement occurs in a transmitter which is part of the aircraft's equipment. Pt2 and Pt7 pressure signals from the engine are connected to this transmitter. The transmitter sends an electrical signal (the proportion of these two pressure signals) to the flight deck.

(c) The first EPR complaint, that the EPR indication alone is not stable, can be the result of a loose connection in the system. This can cause a change which is only in the EPR indication. The second complaint, that the EPR indication moves up and down with other engine parameters, can be the result either of a defect in the fuel control or an aircraft bleed or alternator which starts and stops (this can cause all engine indications to change up and down). The third complaint can be the result of a leak in the Pt2 tube in the nose cone (this will make the Pt2 pressure signal

to the transmitter lower than usual, and the EPR will appear to be higher compared to other engine parameters). A leak in the Pt2 tube outside of the nose cone can occur, but it will not be possible to find this on the ground because the Pt2 pressure and the pressure at the area of the leak will be almost the same. It is possible that this kind of leak will cause a high EPR indication at altitude but will not show on the ground. At altitude nacelle pressure (which will be lower than Pt2) will pressurize the leak. If the Pt7 tube has a leak, the EPR indication will be low compared to other engine parameters. The steps in the troubleshooting diagram are about complaints No. 1 and 3, in this sequence:

1 Steps 1 and 2: Defects in the electrical part of the EPR system. These steps are to correct an EPR indication that is not stable.

2 Steps 3 thru 6: Defects in the Pt7 system. These steps are to correct an EPR indication which is not stable, or an EPR indication which is low in relation to other engine parameters.

3 Steps 7 thru 17: Defects in the Pt2 system. These steps are to correct an EPR indication which is not stable or an EPR which is high compared to other engine parameters.

(2) EPR which is low or not stable. See Figures 101 thru 104.

C. EGT System Troubleshooting

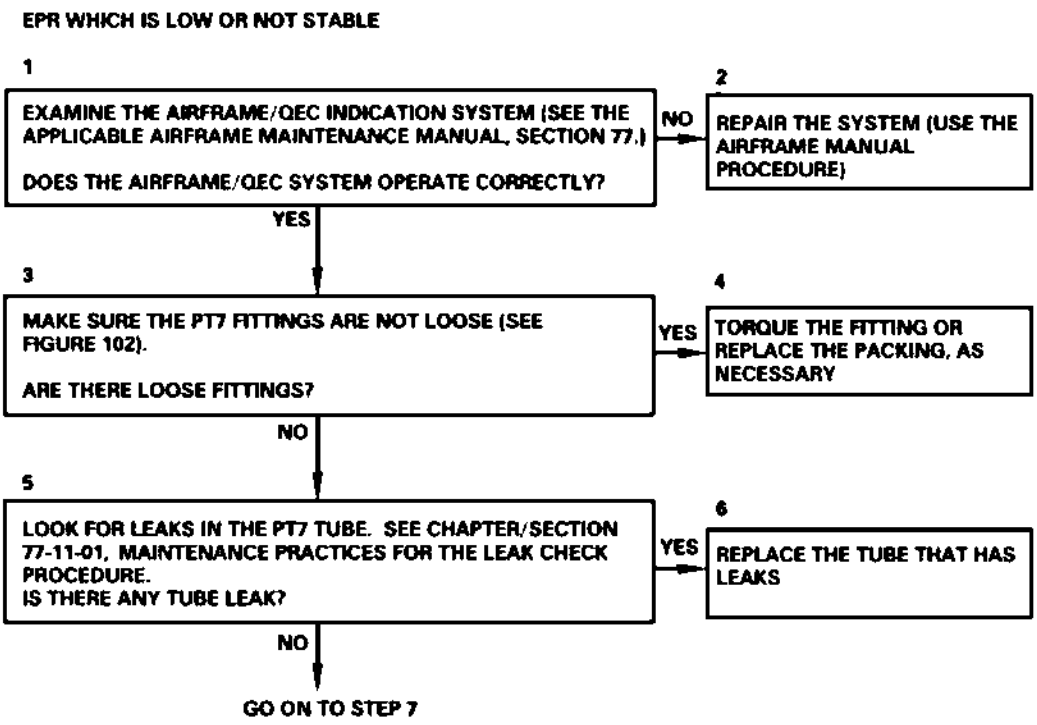
(1) General

(a) This troubleshooting section is about the engine part of the exhaust gas temperature (EGT) indication system. Problems in the airframe indication system cause a large number of EGT complaints. Thus the first step is to examine the airframe/Quick Engine Change (QEC). If the cause of the problem is not in the airframe/QEC, it will then be necessary to look for loose connections, or open circuits related to damaged terminals. After this the correct procedure is to do resistance checks in sequence to find short circuits to ground (which are usually found when

the EGT indication is low) or open circuits (which are usually found when the EGT indication is high).

NOTE: Tests of the EGT cables and probes use an ohmmeter to measure continuity and resistance. The quality of the ohmmeter used will be the limit of how good the test will be. An ohmmeter is not an accurate instrument to measure wire resistances on EGT cables, but it is possible to use one to find a large defect or failure, such as an open or intermittent circuit, or a short circuit from metal to metal. Also, this instrument will measure approximate insulation resistances with these precautions: the ohmmeter must be of good quality and in good condition. The needle must move smoothly, the connection pins or jacks must be tight, and the test leads and batteries must be in good condition (to permit full-scale deflection). Do resistance checks in two steps, first with the leads in one position on the two parts of the circuit, then with each lead where the other was (this corrects for the internal voltage of the instrument). The average of these two indications will be the best test result.

(2) EGT indication does not operate or EGT indication is high or low compared to other engine parameters. See Figures 105 thru 108.


EPR WHICH IS LOW OR NOT STABLE
1
EXAMINE THE AIRFRAME/QEC INDICATION SYSTEM (SEE THE APPLICABLE AIRFRAME MAINTENANCE MANUAL, SECTION 77.)
DOES THE AIRFRAME/QEC SYSTEM OPERATE CORRECTLY?
NO
2
REPAIR THE SYSTEM (USE THE AIRFRAME MANUAL PROCEDURE)
YES
3
MAKE SURE THE PT7 FITTINGS ARE NOT LOOSE (SEE FIGURE 102).
ARE THERE LOOSE FITTINGS?
YES
4
TORQUE THE FITTING OR REPLACE THE PACKING, AS NECESSARY
NO
5
LOOK FOR LEAKS IN THE PT7 TUBE. SEE CHAPTER/SECTION 77-11-01, MAINTENANCE PRACTICES FOR THE LEAK CHECK PROCEDURE.
IS THERE ANY TUBE LEAK?
YES
6
REPLACE THE TUBE THAT HAS LEAKS
NO
GO ON TO STEP 7

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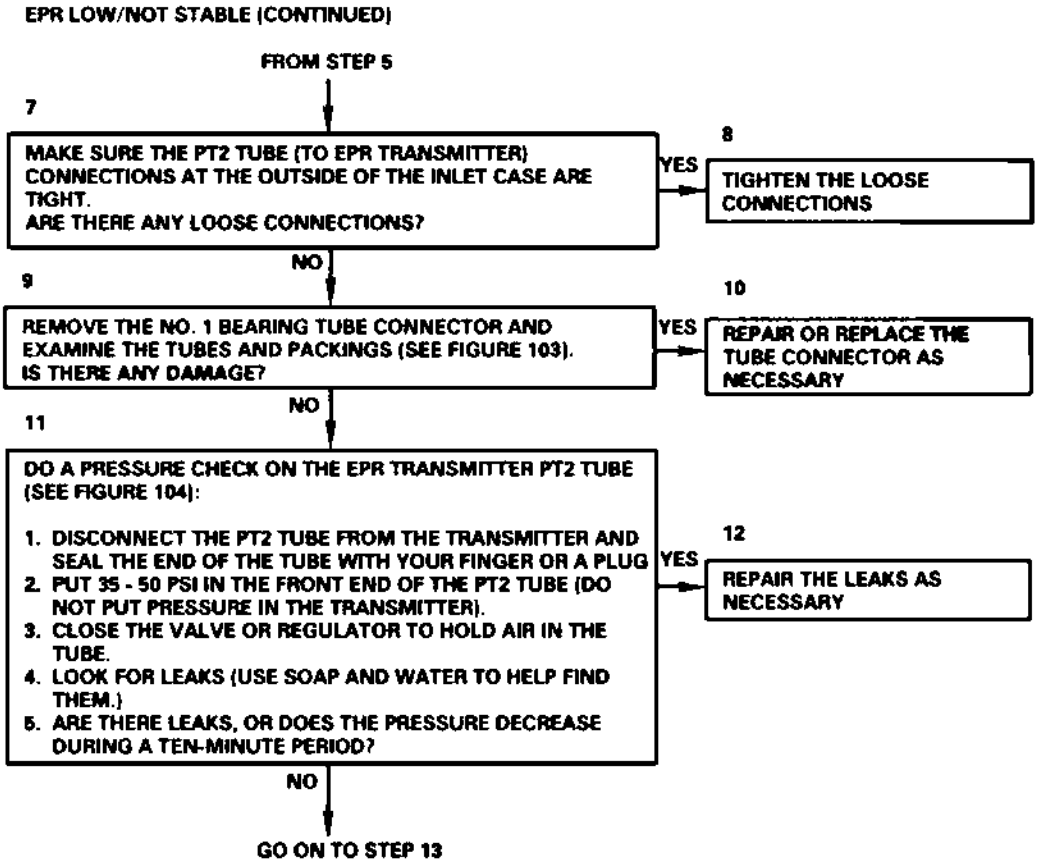
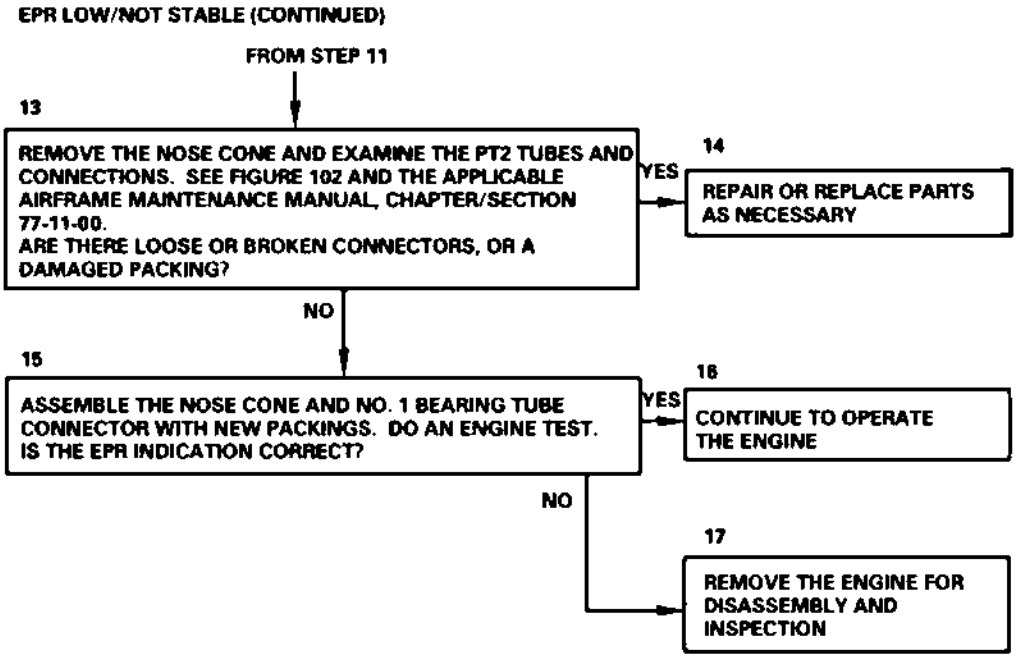
EPR System Troubleshooting
Figure 101 (Sheet 1)
(Task 72-00-00-810-005)


EPR LOW/NOT STABLE (CONTINUED)
FROM STEP 5
7
MAKE SURE THE PT2 TUBE (TO EPR TRANSMITTER) CONNECTIONS AT THE OUTSIDE OF THE INLET CASE ARE TIGHT.
ARE THERE ANY LOOSE CONNECTIONS?
YES
8
TIGHTEN THE LOOSE CONNECTIONS
NO
9
REMOVE THE NO. 1 BEARING TUBE CONNECTOR AND EXAMINE THE TUBES AND PACKINGS (SEE FIGURE 103).
IS THERE ANY DAMAGE?
YES
10
REPAIR OR REPLACE THE TUBE CONNECTOR AS NECESSARY
NO
11
DO A PRESSURE CHECK ON THE EPR TRANSMITTER PT2 TUBE (SEE FIGURE 104):
1. DISCONNECT THE PT2 TUBE FROM THE TRANSMITTER AND SEAL THE END OF THE TUBE WITH YOUR FINGER OR A PLUG
2. PUT 35 - 50 PSI IN THE FRONT END OF THE PT2 TUBE (DO NOT PUT PRESSURE IN THE TRANSMITTER).
3. CLOSE THE VALVE OR REGULATOR TO HOLD AIR IN THE TUBE.
4. LOOK FOR LEAKS (USE SOAP AND WATER TO HELP FIND THEM.)
5. ARE THERE LEAKS, OR DOES THE PRESSURE DECREASE DURING A TEN-MINUTE PERIOD?
YES
12
REPAIR THE LEAKS AS NECESSARY
NO
GO ON TO STEP 13

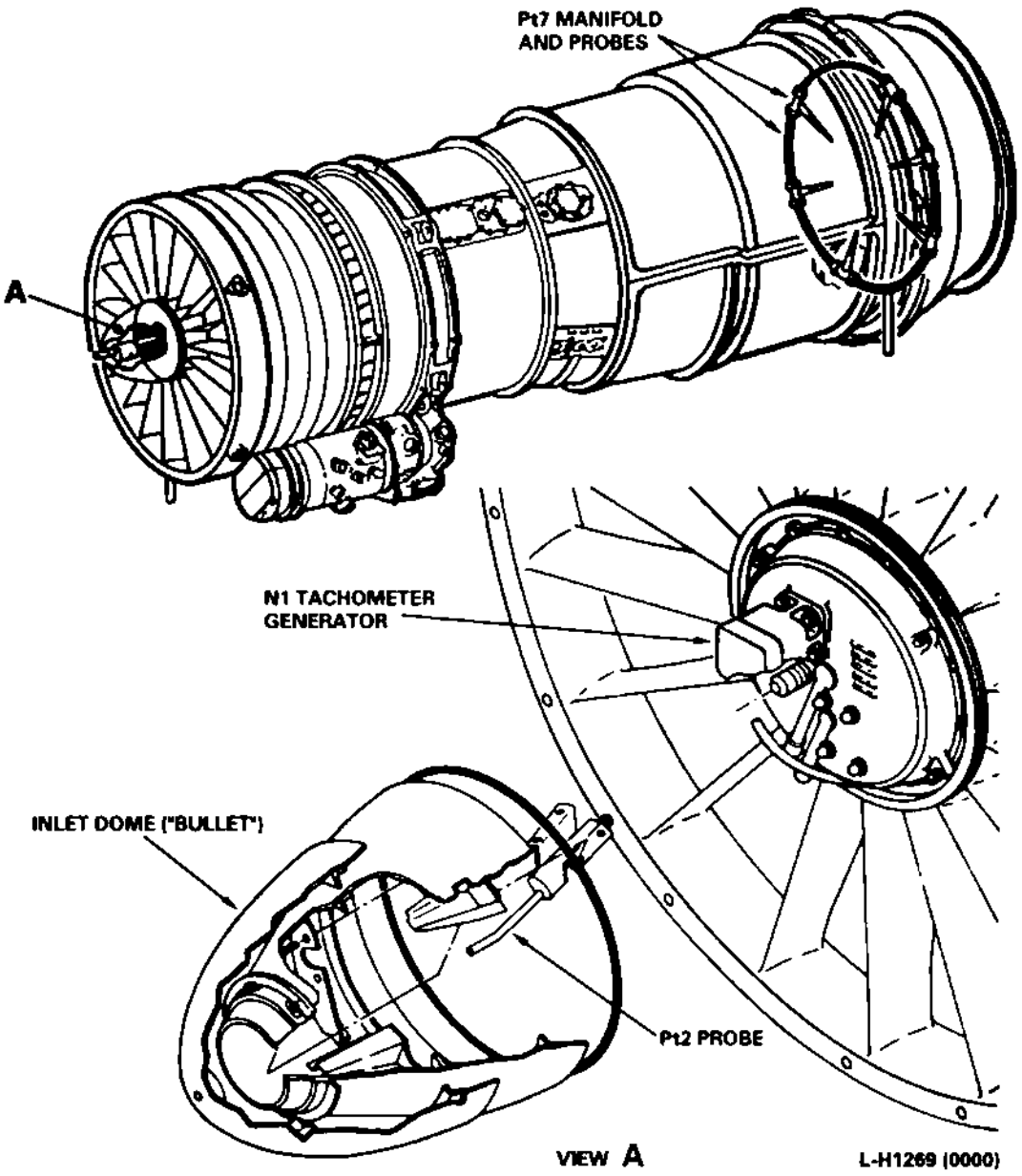
L-H1265 (0701)

EPR System Troubleshooting
Figure 101 (Sheet 2)
(Task 72-00-00-810-005)

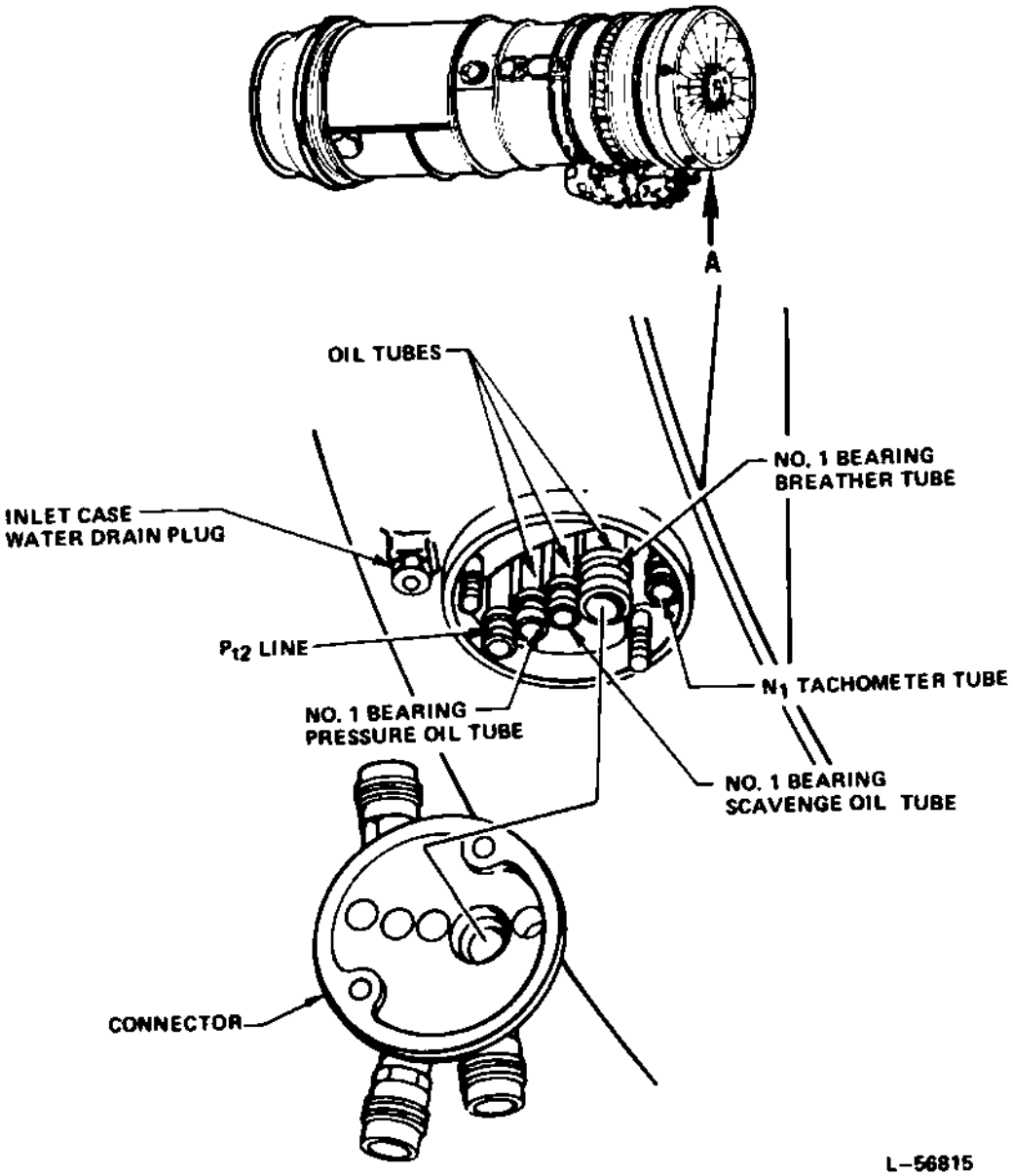

EPR LOW/NOT STABLE (CONTINUED)
FROM STEP 11
13
REMOVE THE NOSE CONE AND EXAMINE THE PT2 TUBES AND CONNECTIONS. SEE FIGURE 102 AND THE APPLICABLE AIRFRAME MAINTENANCE MANUAL, CHAPTER/SECTION 77-11-00.
ARE THERE LOOSE OR BROKEN CONNECTORS, OR A DAMAGED PACKING?
YES
14
REPAIR OR REPLACE PARTS AS NECESSARY
NO
15
ASSEMBLE THE NOSE CONE AND NO. 1 BEARING TUBE CONNECTOR WITH NEW PACKINGS. DO AN ENGINE TEST.
IS THE EPR INDICATION CORRECT?
YES
16
CONTINUE TO OPERATE THE ENGINE
NO
17
REMOVE THE ENGINE FOR DISASSEMBLY AND INSPECTION

L-H1266 (0102)

EPR System Troubleshooting
Figure 101 (Sheet 3)
(Task 72-00-00-810-005)

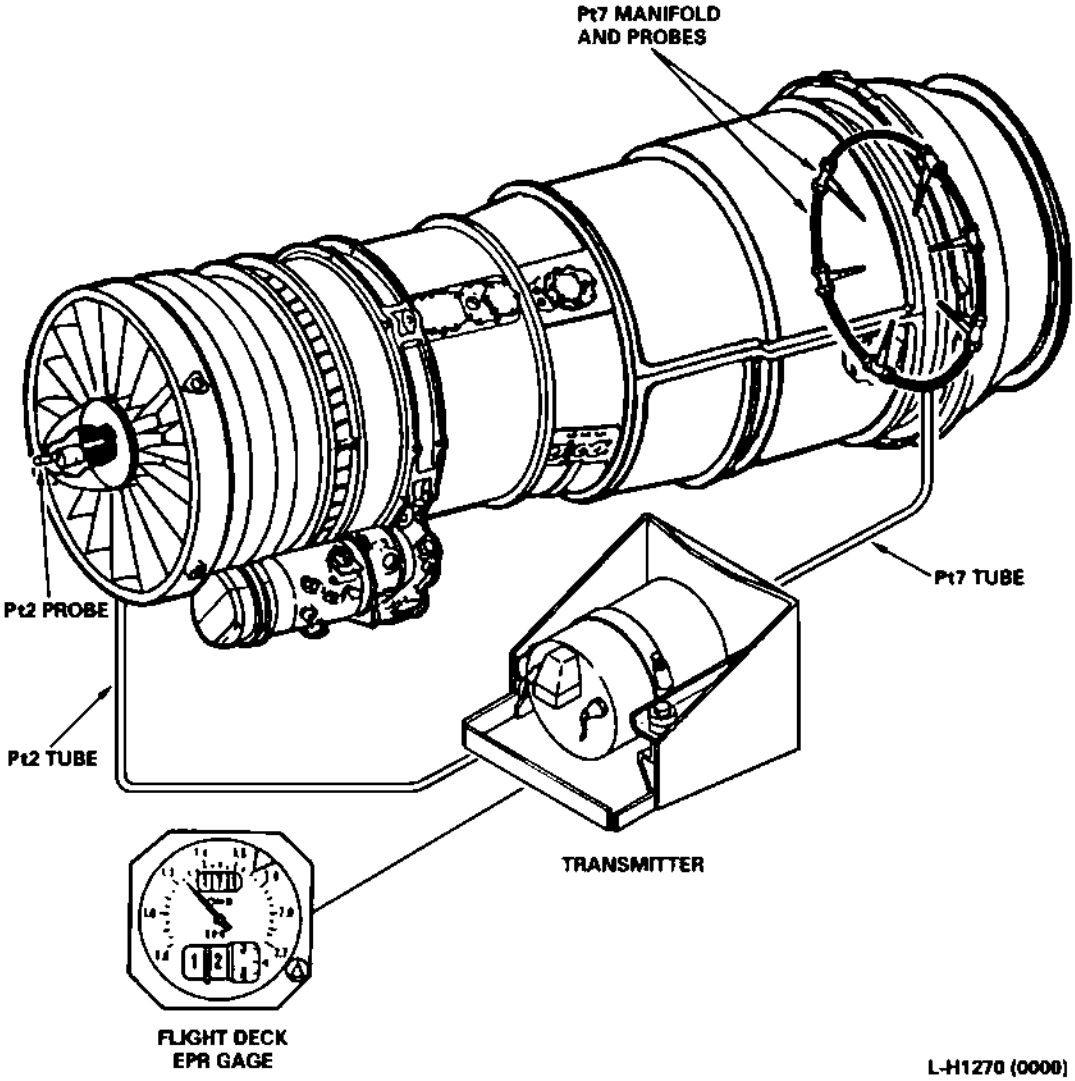


EPR Indication System
Figure 102
(Task 72-00-00-810-005)

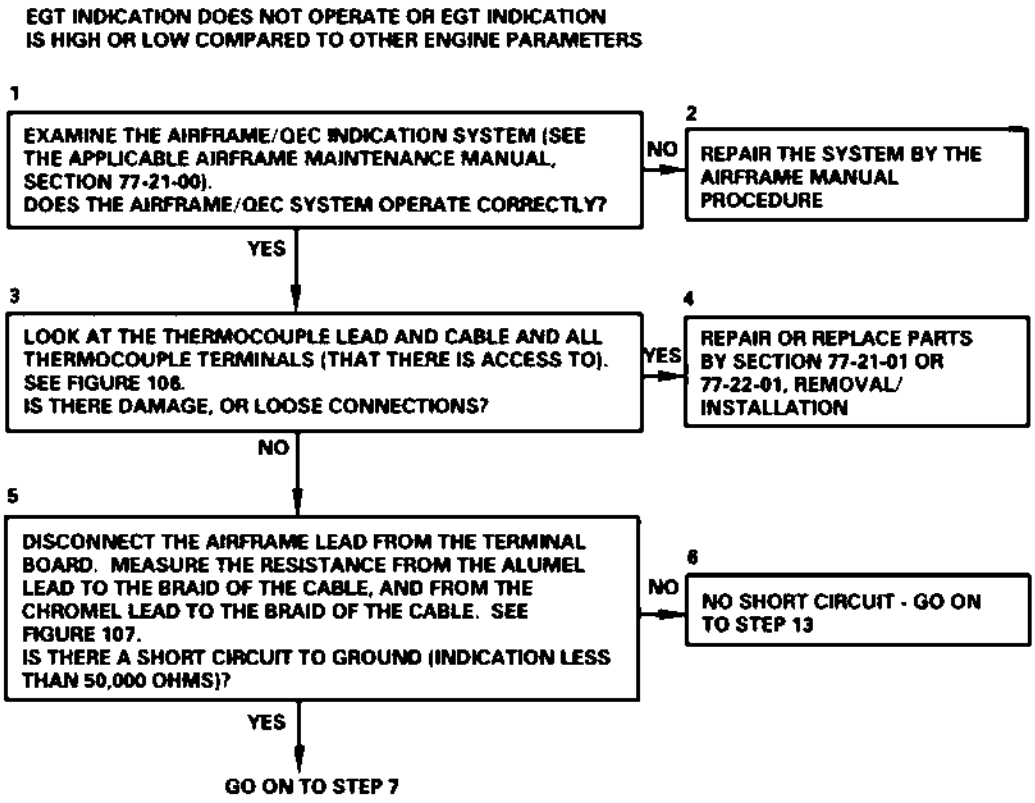


VIEW IN DIRECTION A
(UNDERSIDE OF INLET CASE)

No. 1 Bearing Inlet Case Tubes
Figure 103
(Task 72-00-00-810-005)

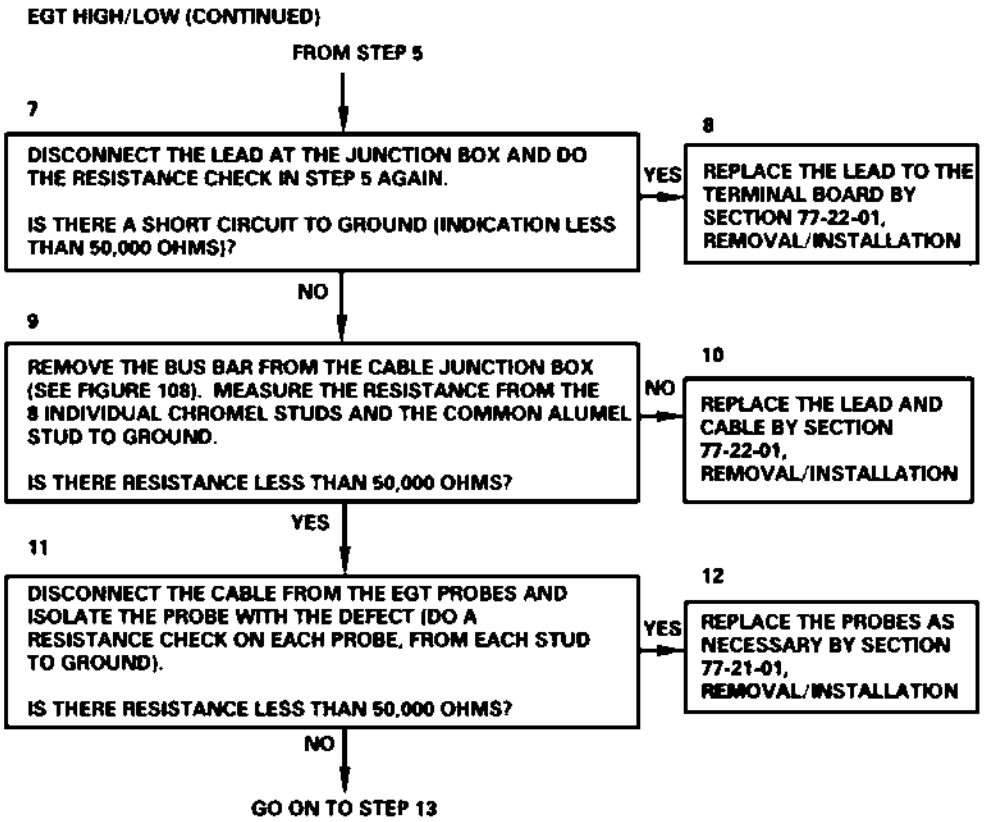


Aircraft EPR Transmitter And Tubes
Figure 104
(Task 72-00-00-810-005)


EGT INDICATION DOES NOT OPERATE OR EGT INDICATION IS HIGH OR LOW COMPARED TO OTHER ENGINE PARAMETERS
1
EXAMINE THE AIRFRAME/QEC INDICATION SYSTEM (SEE THE APPLICABLE AIRFRAME MAINTENANCE MANUAL, SECTION 77-21-00).
DOES THE AIRFRAME/QEC SYSTEM OPERATE CORRECTLY?
NO
2
REPAIR THE SYSTEM BY THE AIRFRAME MANUAL PROCEDURE
YES
3
LOOK AT THE THERMOCOUPLE LEAD AND CABLE AND ALL THERMOCOUPLE TERMINALS (THAT THERE IS ACCESS TO). SEE FIGURE 106.
IS THERE DAMAGE, OR LOOSE CONNECTIONS?
YES
4
REPAIR OR REPLACE PARTS BY SECTION 77-21-01 OR 77-22-01, REMOVAL/ INSTALLATION
NO
5
DISCONNECT THE AIRFRAME LEAD FROM THE TERMINAL BOARD. MEASURE THE RESISTANCE FROM THE ALUMEL LEAD TO THE BRAID OF THE CABLE, AND FROM THE CHROMEL LEAD TO THE BRAID OF THE CABLE. SEE FIGURE 107.
IS THERE A SHORT CIRCUIT TO GROUND (INDICATION LESS THAN 50,000 OHMS)?
NO
6
NO SHORT CIRCUIT - GO ON TO STEP 13
YES
GO ON TO STEP 7

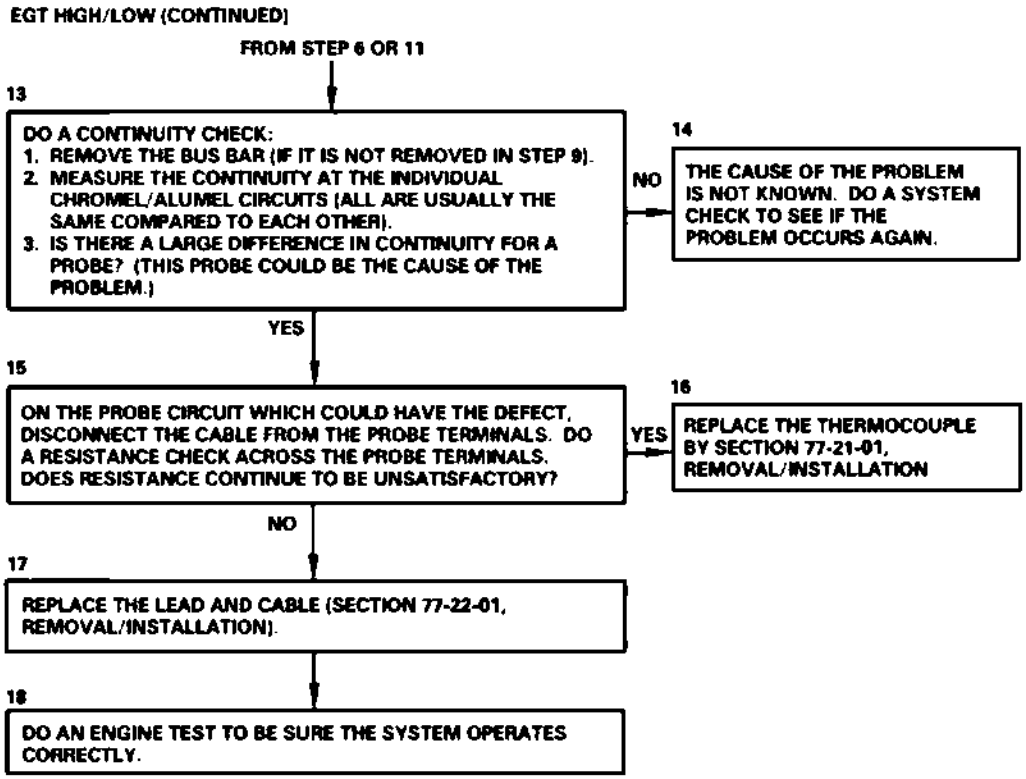
L-H1261 (0102)

EGT System Troubleshooting
Figure 105 (Sheet 1)
(Task 72-00-00-810-005)


EGT HIGH/LOW (CONTINUED)
FROM STEP 5
7
DISCONNECT THE LEAD AT THE JUNCTION BOX AND DO THE RESISTANCE CHECK IN STEP 5 AGAIN.
IS THERE A SHORT CIRCUIT TO GROUND (INDICATION LESS THAN 50,000 OHMS)?
YES
8
REPLACE THE LEAD TO THE TERMINAL BOARD BY SECTION 77-22-01, REMOVAL/INSTALLATION
NO
9
REMOVE THE BUS BAR FROM THE CABLE JUNCTION BOX (SEE FIGURE 108). MEASURE THE RESISTANCE FROM THE 8 INDIVIDUAL CHROMEL STUDS AND THE COMMON ALUMEL STUD TO GROUND.
IS THERE RESISTANCE LESS THAN 50,000 OHMS?
NO
10
REPLACE THE LEAD AND CABLE BY SECTION 77-22-01, REMOVAL/INSTALLATION
YES
11
DISCONNECT THE CABLE FROM THE EGT PROBES AND ISOLATE THE PROBE WITH THE DEFECT (DO A RESISTANCE CHECK ON EACH PROBE, FROM EACH STUD TO GROUND).
IS THERE RESISTANCE LESS THAN 50,000 OHMS?
YES
12
REPLACE THE PROBES AS NECESSARY BY SECTION 77-21-01, REMOVAL/INSTALLATION
NO
GO ON TO STEP 13

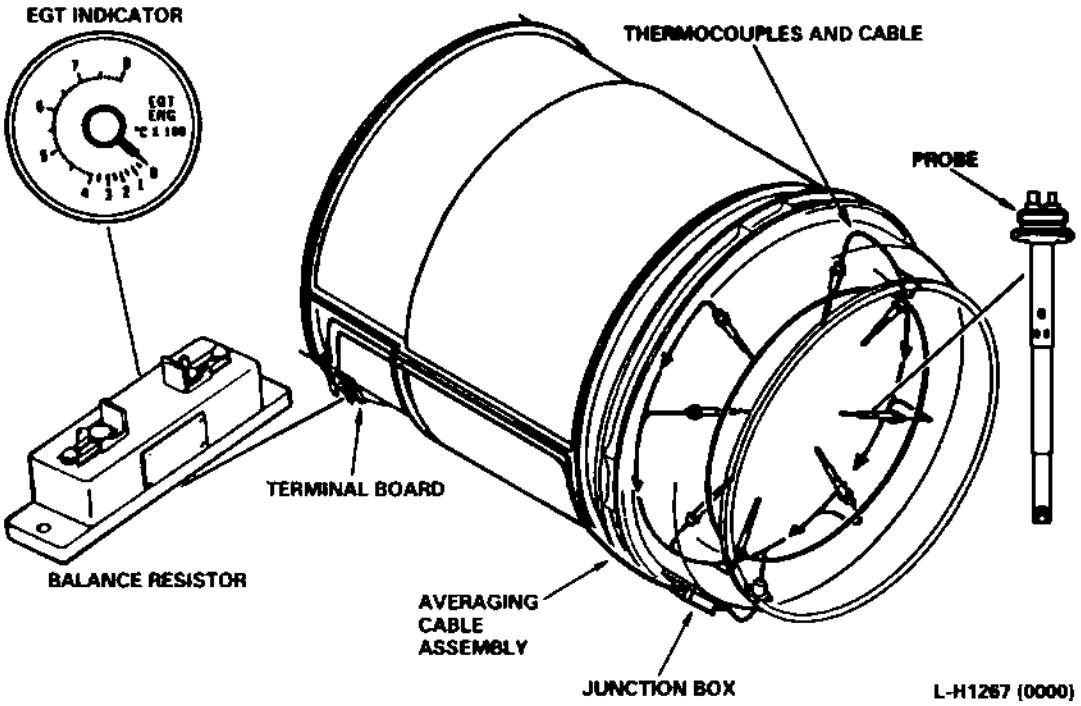
L-H1282 (0102)

EGT System Troubleshooting
Figure 105 (Sheet 2)
(Task 72-00-00-810-005)

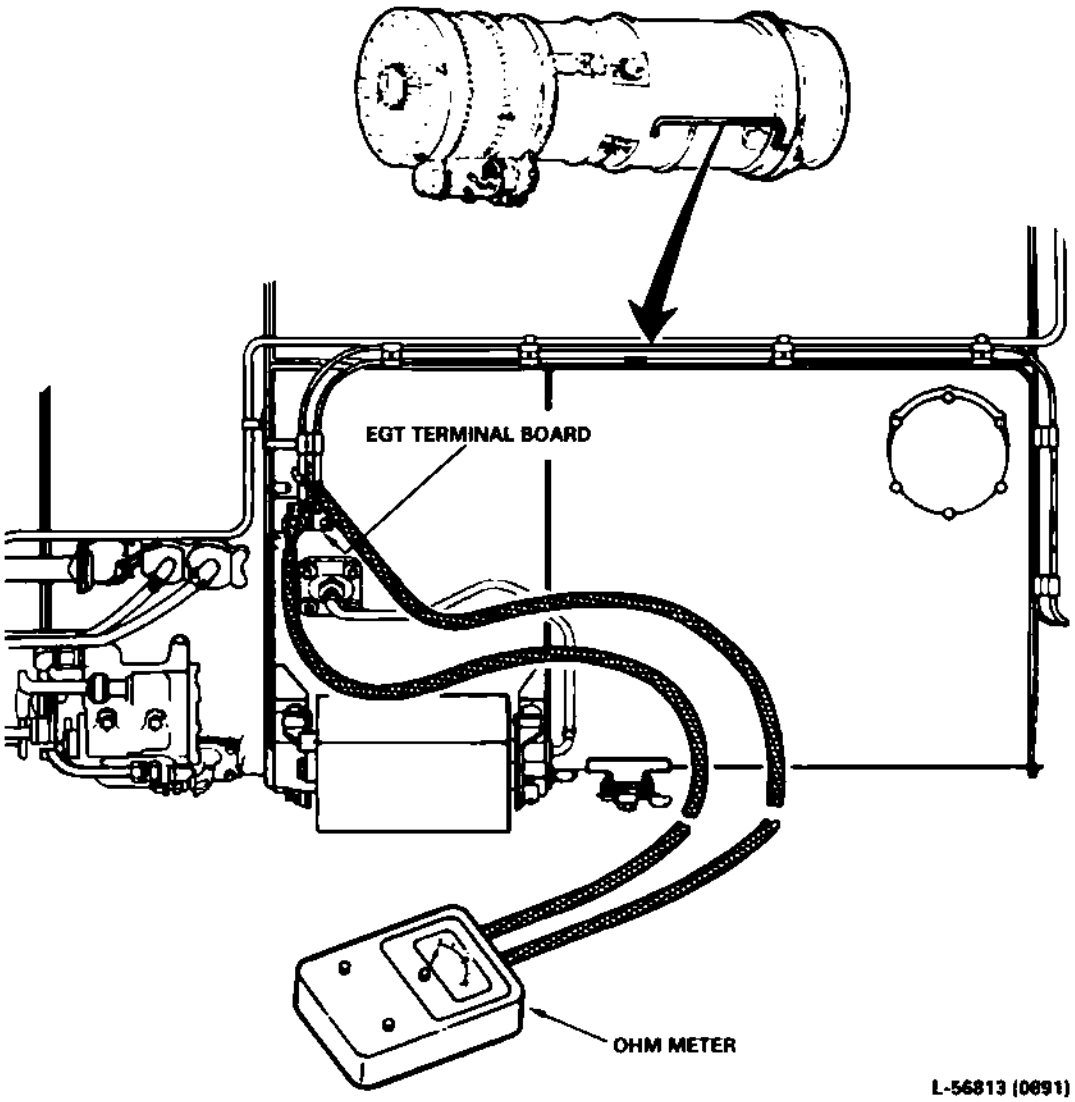

EGT HIGH/LOW (CONTINUED)
FROM STEP 6 OR 11
13
DO A CONTINUITY CHECK:
1. REMOVE THE BUS BAR (IF IT IS NOT REMOVED IN STEP 9).
2. MEASURE THE CONTINUITY AT THE INDIVIDUAL CHROMEL/ALUMEL CIRCUITS (ALL ARE USUALLY THE SAME COMPARED TO EACH OTHER).
3. IS THERE A LARGE DIFFERENCE IN CONTINUITY FOR A PROBE? (THIS PROBE COULD BE THE CAUSE OF THE PROBLEM.)
NO
14
THE CAUSE OF THE PROBLEM IS NOT KNOWN. DO A SYSTEM CHECK TO SEE IF THE PROBLEM OCCURS AGAIN.
YES
15
ON THE PROBE CIRCUIT WHICH COULD HAVE THE DEFECT, DISCONNECT THE CABLE FROM THE PROBE TERMINALS. DO A RESISTANCE CHECK ACROSS THE PROBE TERMINALS. DOES RESISTANCE CONTINUE TO BE UNSATISFACTORY?
YES
16
REPLACE THE THERMOCOUPLE BY SECTION 77-21-01, REMOVAL/INSTALLATION
NO
17
REPLACE THE LEAD AND CABLE (SECTION 77-22-01, REMOVAL/INSTALLATION).
18
DO AN ENGINE TEST TO BE SURE THE SYSTEM OPERATES CORRECTLY.

L-H1283 (0102)

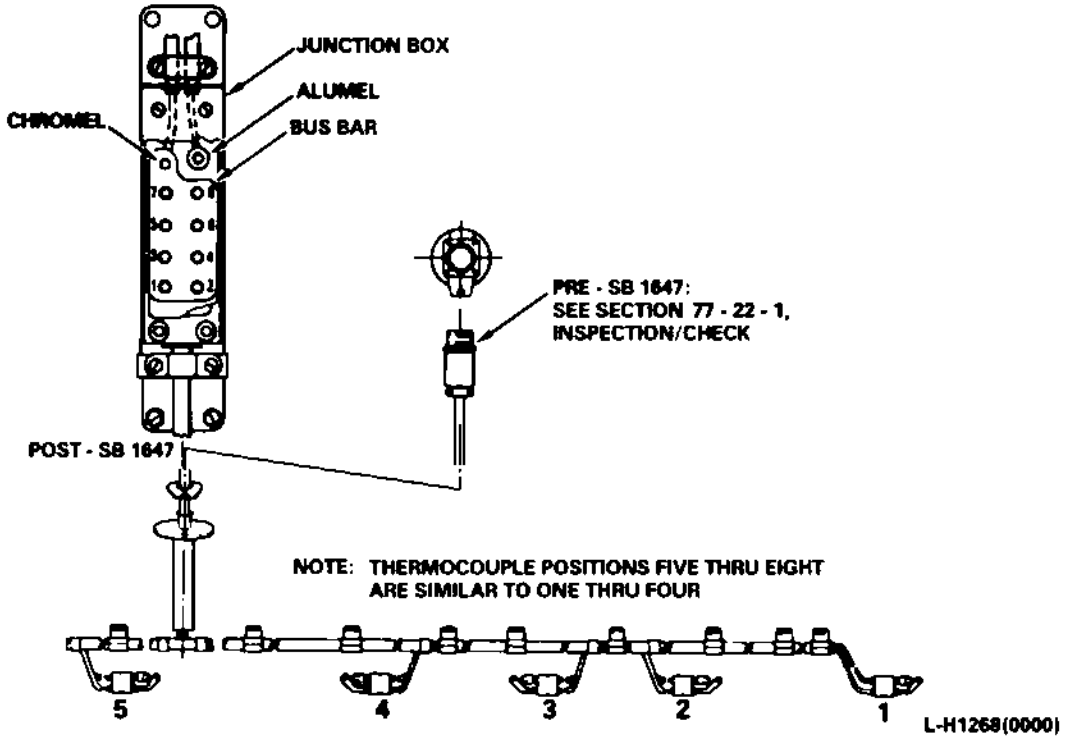
EGT System Troubleshooting
Figure 105 (Sheet 3)
(Task 72-00-00-810-005)



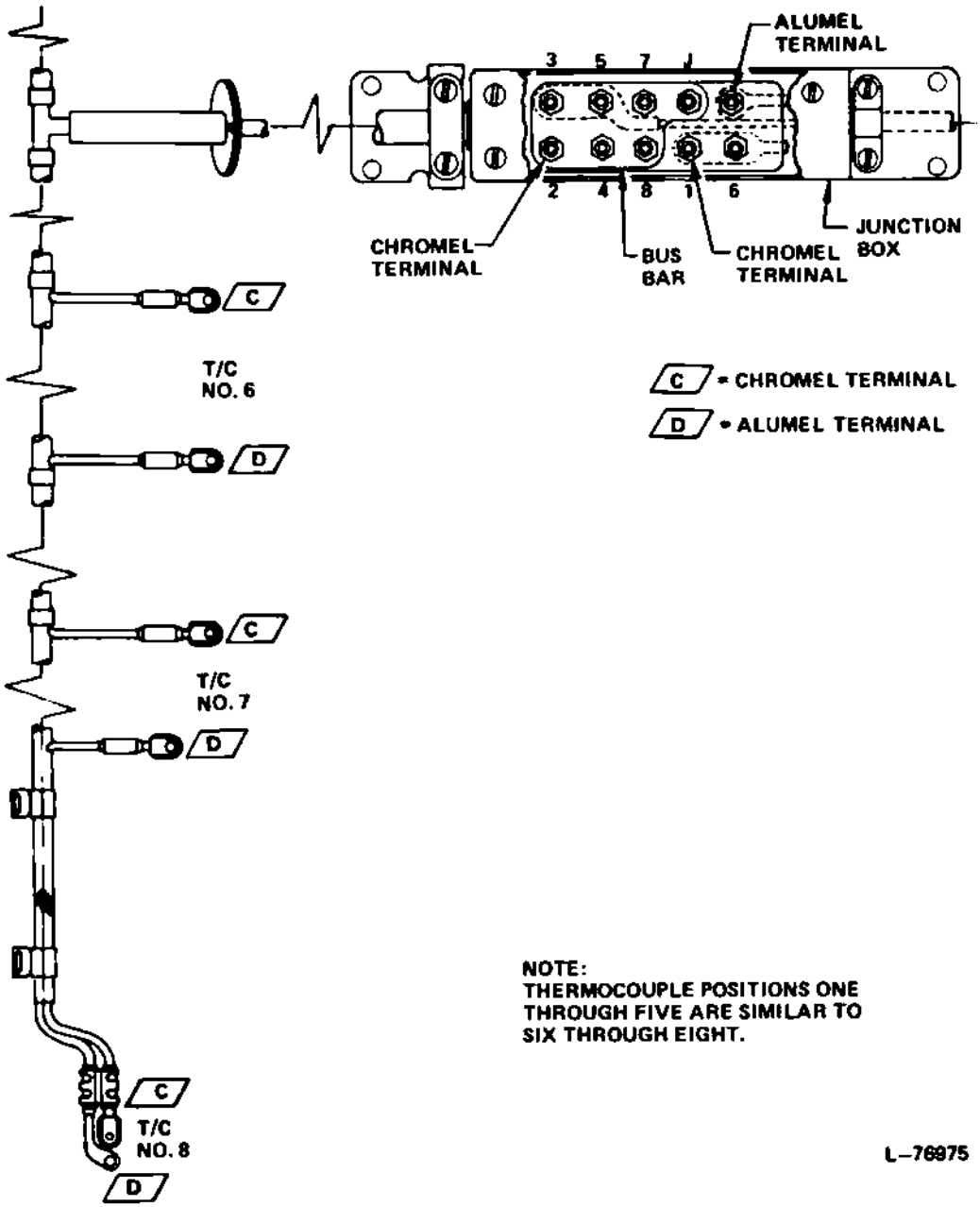
EGT Indication System
Figure 106
(Task 72-00-00-810-005)



EGT Lead Short Circuit Test
Figure 107
(Task 72-00-00-810-005)



EGT Thermocouple Box And Cable
(Non-Boost Circuit Type)
Figure 108 (Sheet 1)
(Task 72-00-00-810-005)



EGT Thermocouple Box And Cable Assembly (Boost Circuit Type)
Figure 108 (Sheet 2)
(Task 72-00-00-810-005)

Task 72-00-00-810-006:

1. Power And Engine Response - Diagrams

A. General

NOTE: This troubleshooting section is as follows:

Symptom	Paragraph
Low Idle N2	B
Surge	C
Slow Acceleration	D
Unable To Reach Takeoff Power	E
Start Problems	F
Flameout	G
Auto-Acceleration	H
Fuel Filter Delta-P Light On	I
Fuel Heat Problem	J
Power Levers Not Aligned (Throttle Stagger)	L
High Fuel Flow (With No EGT Increase)	K
External Fuel Leaks	M
Engine Parameter Fluctuation	N

B. Low Idle N2 Troubleshooting

(1) General

(a) This troubleshooting section is about low Idle N2 complaints caused by:

1 An Idle adjustment ("trim") procedure that was not correct

2 A 13th stage bleed valve (in the start bleed system) that stays open

3 A fuel control that does not operate correctly

4 Damage to the combustion section.

(b) Idle Trim Procedure

1. For the Idle N2 to be in limits, it is necessary to have a good fuel control "trim" procedure with all related precautions, such as ambient temperature accurately measured, air-conditioning packs off, and minimum generator (CSD) and hydraulic pump loads on the engine. If these conditions are not good at the initial trim procedure or on a later trim check, the engine can have a lower N2 at Idle.

(c) Start Bleed Control Valve

1. A low N2 complaint on an engine with a start bleed system (three 8th stage surge bleed valves and one 13th stage start bleed valve) can occur when the 13th stage start bleed valve stays open at Idle. The result of this will be an Idle speed low by 3 - 5 percent. To close the 13th stage start bleed valve, move the power lever to a sufficiently high N2 to cause the start bleed valve control valve to close the 13th stage start bleed valve (approximately 65 percent N2). When the power lever is moved back to the Idle position, the N2 will be in the correct Idle trim band. If this procedure is not done, the Idle will continue to be 3 - 5 percent low. If the Idle trim is correctly set, and the power lever was moved sufficiently to close the 13th stage start bleed valve, the Idle N2 will be apparently correct during the remaining checks.

2. If the start bleed control valve did not operate, it is possible that the 13th stage start bleed valve will stay closed. If the 13th stage bleed valve is closed during the start procedure, there will be a higher exhaust gas temperature (EGT) than is usual during the start. This can cause hot starts (high EGT) or "hung" starts (where the engine does not fully accelerate). It is possible to get a good start with some engines during the first start of the day. As the ambient temperature increases during the day, the EGT can increase with each start until a hot or "hung" start occurs. It is important that the start bleed control valve operate correctly, for the initial Idle trim procedure and for normal Idle operation and normal start procedures.

(d) Fuel Control

1 If the fuel control does not operate correctly, this can show in different ways, and low Idle N2 can be the result. If it is not possible to get good Idle trim or to do a good Idle trim check with all the usual precautions, this can be because the fuel control did not operate correctly. Other complaints can occur because of the fuel control, such as power lever handles at different positions for the same power level in all engines ("throttle stagger") or slow engine acceleration when the power lever is moved. Complaints of "throttle stagger" and slow acceleration can also be the result of combustion chamber distress.

NOTE: Power levers not aligned ("throttle stagger") can be more than a nuisance flight crew complaint. If the power lever knobs are no more than one and one-half knobs away from each other at Takeoff power, correct this at the immediately subsequent time when it is possible to do a trim procedure. If the power levers are more than one and one-half knobs away from each other, correct this before the immediately subsequent flight (measure power lever position from the rear surface of each knob). It is possible to correct "throttle stagger" with a trim procedure, but if "throttle stagger" occurs too many times, this is a symptom of changes in engine operation levels. These changes can be the result of:

- Bleed system defects
- EPR system defects
- Engine gaspath part damage
- Combustion chambers not aligned.

These conditions can cause EGT- or power lever-limited operation.

(e) Combustion Chamber Distress

1. Damage to the combustion section can cause bad performance, with the result that the Idle N2 is not in limits. The damage can get worse and can change from day to day. If the damage gets worse, it is possible that a mechanic will do an Idle trim procedure again and again, in error, to correct low Idle N2. With some combustion chamber damage, part of the combustion chamber can separate and let the chamber move aft (this causes distortion of the gas flow into the turbine vanes). This condition can show as irregular Idle N2 if the broken part of the combustion chamber moves during engine operation. It can also show as complaints of "throttle stagger" or slow acceleration. If an Idle trim check does not find the cause of the complaint, the cause can be combustion chamber damage which causes the problem one time and then is not seen at other times. When an Idle trim check is done, it is possible that this condition will not show as low Idle N2 during the engine check run.

2. If the Idle N2 is adjusted ("trimmed") more than two times, and the cause of the low Idle N2 is not found, the cause of the low Idle N2 can be combustion chamber damage. Combustion section inspection is necessary with such an engine, to prevent continued engine operation with combustion section damage. The steps in the troubleshooting diagram are about the low Idle N2 complaints, with procedures in this sequence:

Steps 1 thru 10	Do an Idle trim check to be sure that the engine was adjusted ("trimmed") correctly, and to be sure that there were no complaints before about low Idle N2, "throttle stagger", or slow acceleration.
Steps 11 thru 13	Do a check of start bleed control valve operation
Steps 14 thru 17	Look for damage to the combustion section

(2) Procedures See Figure 101.

C. Surge

(1) Surge Description

(a) When a jet engine is operated, a number of different types of compressor surge can occur. These surges can show as compressor pulsations in the aircraft structure or when an engine has too high an EGT; it is possible to hear some surges, or to see that the engine speed does not go higher when the power lever is moved forward, or that the engine speed decreases when the power lever is not moved. Surges can therefore be of many types, from a weak type which has no sound, motion, or other indication that the pilot can find, to stronger surges which make loud noises or which quickly make the engine temperature too high.

(b) Sometimes things other than a surge can cause the effects described above. If something goes into an engine, or if an airfoil breaks, this can cause a loud noise. Different things can cause the temperature to be too high or can cause engine limits to change too quickly.

(c) Many things can cause surges: The condition of the engine gaspath, how the engine systems are operated, things external to the engine, or some of these things together. If the cause of the surge is external to the engine (such as inlet blockage by snow or soft objects, water or ice that gets into the inlet, or hot or turbulent air in the inlet), it is possible that there will be no damage to the engine after the surge, and no repair will be necessary. If a surge caused by external forces made the engine temperature too high or caused vibration, it will be necessary to inspect the engine as shown in Adjustment/Test or Inspection/Check in this manual. How the engine is operated can also make an engine surge. If the thrust reverser is used incorrectly, or if the power lever is moved forward and back too quickly, this can cause a surge. During an engine test for surge it is important to obey the time limits in this manual to prevent surges from incorrect operation. For example, it is necessary to complete a specified time at Idle after Takeoff power is used, before the engine is operated at a higher level or is given a shutdown procedure.

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R

(2) Off-Idle Surge Procedures. See Figure 102 and Figures 106 thru 110.

(3) High Power/Takeoff Roll/Steady State Cruise Surge. See Figure 103.

(4) Deceleration Surge. See Figure 104.

(5) Reverse Surge. See Figure 105.

D. Slow Acceleration

(1) General

(a) Slow acceleration can be dangerous to flight safety. Sufficient engine response time must be available for emergency go-around if necessary. There can be many causes of slow acceleration, such as minor engine fuel control adjustments which are necessary, combustion chamber failures (which can be dangerous), or fuel leaks which are a result of primary or secondary fuel manifold fractures.

R (b) Line maintenance actions must be as specified by the airframe manufacturer, engine manufacturer, or airline engineering department. Thus flight crew reports which occur again and again, or reports of unusually large changes in engine parameters can show that more troubleshooting procedures are necessary.

(c) It is important to make sure that the engine has become stable at the correct idle speed as given in the applicable flight manual, before you apply external loads (especially air conditioning) to the engine, and before you accelerate the engine. This will give optimal engine acceleration.

(2) Procedures. See Figure 111 thru Figure 114.

E. Unable To Reach Takeoff Power

(1) General

(a) When an engine cannot go to Takeoff power, this can be because of:

- Redline limits
- Throttle position limits
- Unusual engine response.

(b) The cause of this complaint can be problems with:
- Indication (EPR, EGT, N1/N2)
- Anti-surge bleed (Ps3 pressure, strainer, pressure ratio bleed control, start bleed control valve, engine compressor bleed valves)
- Aircraft air system (leaks)
- Gaspath (damage to the inlet, compressor, combustion section, turbine, exhaust)
- Fuel (supply, fuel pressure, fuel control, primary or secondary fuel manifold, Ps4 signal, pressurizing and dump valve)

1 Fuel: The most frequent fuel cause is fuel flow which is not sufficient (the fuel flow and EGT for the engine will be low compared to other engines).

2 Indication: See Troubleshooting-03.

3 Anti-surge bleed: If bleed valves do not close correctly this can cause a large fuel flow and EGT increase but only a small engine speed decrease. Idle power will be apparently normal.

4 Anti-ice and aircraft air systems: Defects in these systems can cause overheat or fire warnings. If engine power decreases, it is easy for the flight crew to increase the power (with higher fuel flow and EGT); it is possible that engine speed limits will prevent Takeoff power operation.

5 Gaspath: A damaged gaspath will cause high EGT and fuel flow, but engine speed can be high or low. It is possible that there will be slow acceleration, difficult starts, surge, or throttle handles at different positions ("throttle stagger").

NOTE: Power levers not aligned ("throttle stagger") can be more than a nuisance

R
R

flight crew complaint. If the power lever knobs are no more than one and one-half knobs away from each other at Takeoff power, correct this at the immediately subsequent time when it is possible to do a trim procedure. If the power levers are more than one and one-half knobs away from each other, correct this immediately (before subsequent takeoff of the aircraft) (measure power lever position from the rear surface of each knob). It is possible to correct "throttle stagger" with a trim procedure, but if "throttle stagger" occurs too many times, this is a symptom of changes in engine operation levels. These changes can be the result of:

- Bleed system defects
- EPR system defects
- Engine gaspath part damage
- Combustion chambers not aligned.

These conditions can cause EGT- or power lever-limited operation.

6 The steps in the troubleshooting diagrams are about engine complaints (compared to another engine in the aircraft) in this sequence:

Step 1: EGT (only)
Step 3: All parameters
Step 5: Fuel flow and EGT high
Step 33: No throttle response, or unusual engine response
Step 39: Power lever "throttle limited", with other parameters high but in limits

(2) Procedures. See Figures 115 thru 118.

F. Start Problems

(1) General

(a) No Start

1. An engine will start if the rotors turn, the gas path is in good condition, and there is fuel and ignition.

2. When an engine does not start, it is important to know as much as possible about what occurred when the start was tried. For example:
   - Did the rotors turn (was it possible to hear the N1 or N2 rotors turn, or see the N1 move)?

   NOTE: There can be too much friction between the rotor airseals and the mating stator lands (or between the blade tips and the outer airseals) if the engine was stopped too fast without a sufficient cool-down period to make the internal temperature lower. When this occurs it can be difficult to turn one or both rotors until the internal temperatures get sufficiently low to release the rotors. Do not put too much force on a rotor to try to turn it, because it is possible to damage the blades and airseals. Let an engine get down to a lower temperature before you either start it or try to turn the rotors.

   - Was there indication of fuel flow or EGT increase?
   - Was the ignition system on?

(b) Hot Start

1. An engine has a "hot start" when the EGT is high during the start (or when the EGT will become high if the engine is not stopped). "Hot starts" occur when:

   - Fuel flow is too high
   - There is a high ambient temperature
   - N2 is low during the start
   - Starter air pressure is low
   - There is gas path damage.

(c) Hung Start

1 An engine has a "hung start" when the engine starts, N2 and EGT are stable, but the power level does not increase to idle.

(2) Procedures

(a) No Start. See Figure 119 and Figure 120.

(b) Hot Start. See Figure 121.

(c) Hung Start. See Figure 123.

G. Engine Flameout

(1) General

(a) If an engine has a flameout, there can be four causes:
- Irregular fuel supply
- Bad weather operation
- Engine gas path damage
- Engine component problem

1 Irregular Fuel Supply

a If the fuel flow is stopped for a short time (this time can be as short as 0.1 second), an engine can have a flameout. If there was sufficient water in the fuel system to fill part of the engine fuel manifolds for a short time, this can cause a flameout. Blockage of the fuel system upstream of the engine can cause flameout. If the blockage or contamination goes away in a short time, it will usually be possible to get a satisfactory start.

2 Bad Weather

a During takeoff a large quantity of ground water (rain, snow, slush, etc.) in the engine can cause flameout (gas path damage can also occur from this). During flight operations in extreme weather conditions (rain, hail, etc.), at power levels lower than those recommended for these conditions, flameout can occur. If there is no damage to the engine, it is usually possible to get a satisfactory in-flight start.

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3 Gas Path Damage

a Engine gas path damage can occur from different causes, and the result can be engine flameout. If this occurs it is not usually possible to start the engine again.

4 Engine Component Problem

a There are engine component problems that can cause engine flameout. Problems with the fuel pump, fuel control, and fuel pressurizing and dump valve can cause irregular or stopped fuel flow and cause a flameout (with these problems it is not usually possible to get the engine started again in-flight). Problems with the fuel control Pb tube or fuel deicing system can be a flameout cause, but with these causes an in-flight start is frequently possible

(2) Procedures

(a) Engine Flameout See Figures 124 and 125.

H. Engine Auto-Acceleration

(1) General

(a) An engine has an auto-acceleration if the engine speed increases automatically. The cause of this can be:

1 A defect in the fuel control or fuel pump

2 An aircraft auto-throttle system that does not operate correctly.

3 Incorrect operation of the auto-throttle system.

(b) The first thing it is important to know is if engine operation went above the speed or temperature limits in Adjustment/Test-01 during the auto-acceleration. If engine operation went above these limits, it can be necessary to replace the engine. It will be necessary to find and correct the problem so that it does not occur again.

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(c) Auto-acceleration of the engine can occur when some of the N2 signal to the fuel control does not get to the fuel control because the drive shaft between the fuel pump and the fuel control is damaged but is not fully disengaged from the fuel control. When this occurs the fuel control gets a speed signal that is lower than N2, and the fuel control will schedule a high level of fuel flow. The result will be an auto-acceleration which the power lever will not control. Another cause of auto-acceleration can be an N2 signal which does not get to the fuel control because the fuel pump drive shaft between the pump and the control is broken (when this occurs, the fuel pump will continue to pump fuel, but the fuel control will get a "Zero N2 Level" signal). If the N2 signal goes to zero at a sufficiently high power level, the engine will usually "auto-decelerate"; if the power level is lower when the N2 signal goes to zero, the engine will usually auto-accelerate.

(d) If the fuel control does not get an N2 signal, it will usually not be possible to start the engine again after it is stopped. However, if a start is possible, the engine will continue to accelerate slowly to a speed above Idle. This engine could have a surge at an N2 not too much above Idle during its acceleration.

(e) If a Ps4 signal does not get to the fuel control, this can cause acceleration problems. Low temperatures at altitude can freeze water in a Ps4 moisture trap and in the burner pressure bellows of the fuel control. On the ground (when temperatures are higher), this ice is gone, and it can be difficult to find this contamination. Frequent inspection of the moisture trap and servicing of the bellows with silicone oil can prevent this contamination.

(f) It is possible that the aircraft auto-throttle system caused the auto-acceleration; do not operate the engine until the cause of the auto-acceleration is known (or the defect can cause this engine or a replacement engine to go above limits). If it was necessary to replace the engine because it went above limits, make sure the auto-throttle system of the aircraft did not cause the auto-acceleration. If the aircraft

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auto-throttle system has a defect, it can cause the engine power lever to go too far forward (look at the aircraft maintenance data for the auto-throttle system to see if this occurred). Because it will not be possible to know of defects in the fuel pump and fuel control of the removed engine, do not use this pump and control on the replacement engine. It is recommended that the mechanic find as much as possible about how the auto-acceleration occurred.

(g) If the auto-throttle system is used incorrectly, this can also cause the engine power lever to go too far forward. Make sure that the auto throttle system is operated only as permitted by the approved flight deck procedures.

(2) Procedures. See Figure 126.

I. Fuel Filter Delta P Light Stays On When Fuel Heat Is Energized

(1) General

(a) The fuel filter differential pressure warning ("Delta P Light") can come on when there is blockage of the fuel pump filter. Water which freezes in the fuel filter (or other contamination) can cause this. Usually the flight crew energizes the fuel deicing system to correct this problem in flight. If there is a defect in the fuel deicing system, ice can collect in the filter in flight but will melt on the ground before maintenance operations can find it. If the fuel filter Delta P Light stays on, look for water (or other contamination) in the filter. Look also at the engine and airframe deicing systems (differential pressure switch, air actuator, and airframe circuit).

(2) Procedures. See Figure 127 and Figure 128.

J. Fuel Temperature Does Not Increase When Fuel Heat Is Energized (Douglas Installation Only)

NOTE: Fuel temperature indication at the fuel pump downstream of the fuel heater is measured only on Douglas installations. On Boeing installations fuel temperature is measured only at the No. 1 fuel tank.

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(1) General

(a) The fuel deicing system removes ice from fuel in the fuel filter with heat from the fuel heater. This fuel heater uses hot rear compressor air from the engine (controlled by a fuel deicing air actuator and valve) to increase the fuel temperature when the fuel deicing switch is operated on the flight deck.

(b) Fuel goes from the fuel heater through the fuel filter to the main stage of the fuel pump. From there the fuel goes to the fuel control and from the fuel control to the fuel-oil cooler. The fuel is usually colder than the oil, with the result that the fuel keeps the oil temperature lower. If the fuel temperature increases, the oil temperature will increase also. Therefore when the fuel deicing system operates correctly, there will be an increase in oil temperature when fuel heat is energized.

(c) If the selection of fuel heat has no effect on fuel temperature, look for an oil temperature increase or an indication that the actuator and valve operated. If these (or a check of the circuit from the aircraft flight deck to the actuator) do not show the cause, damage to the fuel pump is a possible cause. If something stops the impeller stage of the fuel pump, a bypass valve will cause fuel to go around the fuel heater and filter to the pump main stage (if this occurs the selection of fuel heat will have no effect on the fuel temperature). See Figure 129 for a schematic of this system.

(2) Procedures. See Figure 129 thru 131.

K. High Fuel Flow (With No Increase in EGT)

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(1) Engines with damaged or chafed fuel manifolds can show an increased fuel flow indication without the usual related EGT increase because of fuel leakage (manifolds can get damage from loose left or right diffuser duct segments or front or rear fuel manifold fairings). The increase in fuel flow indication on an engine with a fractured fuel manifold (compared to other engines) can be up to 2000 pounds per hour during Takeoff, 1500 pounds per hour during Climb and 400 - 500 pounds per hour during Cruise, without a related increase in EGT.

(2) To remove a fractured secondary fuel manifold as a cause of high fuel flow reading with no related increase in EGT, do Test C - Ground Check at 3000 lb/Hr (See Adjustment/Test). Immediately after engine shutdown, Examine the fan duct area for collected fuel or duct areas wet with fuel. If fuel or fuel-wet areas are found, look for damaged fuel secondary manifolds and repair as necessary.

(3) An engine with fractured secondary fuel manifolds can have other symptoms:

(a) Slow Acceleration

(b) Unable To Reach Takeoff Power

(c) Power Levers Not Aligned (Throttle Stagger)

L. Power Levers Not Aligned (Throttle Stagger)

(1) Power levers not aligned (throttle stagger), can be more than a nuisance flight crew complaint. If the power lever knobs are no more than one and one-half knobs away from each other at Takeoff power, correct this at a subsequent time when it is possible to do a trim procedure. If the power levers are more than one and one-half knobs away from each other, correct this immediately before the subsequent flight. (Measure power lever position from the rear surface of each knob.) It is possible to correct "throttle stagger" with a trim procedure, but if "throttle stagger" occurs too many times, this is a symptom of changes in engine operation levels. These changes can be the result of:

(a) Bleed system defects

(b) EPR system defects

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(c) Engine gaspath part damage

(d) Combustion chambers not aligned

(e) Fractured or chafed primary or secondary fuel manifolds

NOTE: Fuel manifolds can get damage from loose left or right diffuser duct segments or front or rear fuel manifold fairings.

(2) The above conditions can cause EGT-limited or power-limited operation, To remove a fractured secondary fuel manifold as a cause of "throttle stagger", do Test-Ground Check at 3000 Lb/Hr (see Adjustment/Test). Immediately after engine shutdown, examine the fan duct area for collected fuel or duct areas wet with fuel. If fuel or fuel-wet areas are found, look for damaged fuel secondary manifolds and repair as necessary.

M. External Fuel Leaks

(1) If leaks found after engine shutdown cone from unknown sources (for example connections or fittings), repair these leaks and test the engine as specified in the Repair Reference Table (Adjustment/Test). If the source of fuel leakage is not known, use this troubleshooting procedure to find the leak:

(a) Clean all areas of the engine where the leak could be. It is permitted to use PMC 4356 fluorescent penetrant developer, (for example Magnaflux ZP4) on all areas of the engine where the leak could be.

(b) Run the engine at Takeoff Power (Normal Takeoff for JT8D-17R or -17AR) for five minutes.

(c) Do an engine shutdown and keep fuel pressure to the main fuel pump inlet. Look for leaks on the engine.

NOTE: The color of dry developer becomes gray when it touches oil, fuel, hydraulic fluid or other hydrocarbons.

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R

(d) Repair the leak, When all leaks are repaired, refer to the Repair Reference Table (Adjustment/Test) for the necessary test.

(2) If there is leakage from the overboard drain which is not in limits, see (Adjustment/Test), run the engine at Takeoff power (Normal Takeoff for JT8D-17R or -17AR) for five minutes. Do a shutdown, then look for leaks. Repair the leak. When all leaks are repaired, refer to Reference Table (Adjustment/Test) for the necessary test.

N. Engine Parameter Fluctuation

(1) Engine parameter fluctuation is periodic or random change of WF, EPR, EGT, N1, or N2 which continues during steady state engine operation. The period between parameter changes can be from approximately three seconds to three minutes. Parameter fluctuation is a much slower change than low frequency vibration or engine "rumble".

(2) Parameter fluctuation may be caused by defects in the indicating system (ATA 77), fuel system (ATA 73), pneumatic system (ATA 36), controls system (ATA 22), engine externals or gas path (ATA 72).

(3) To prevent engine component removals which are not necessary, it is necessary to use the procedure shown in Figure 132.

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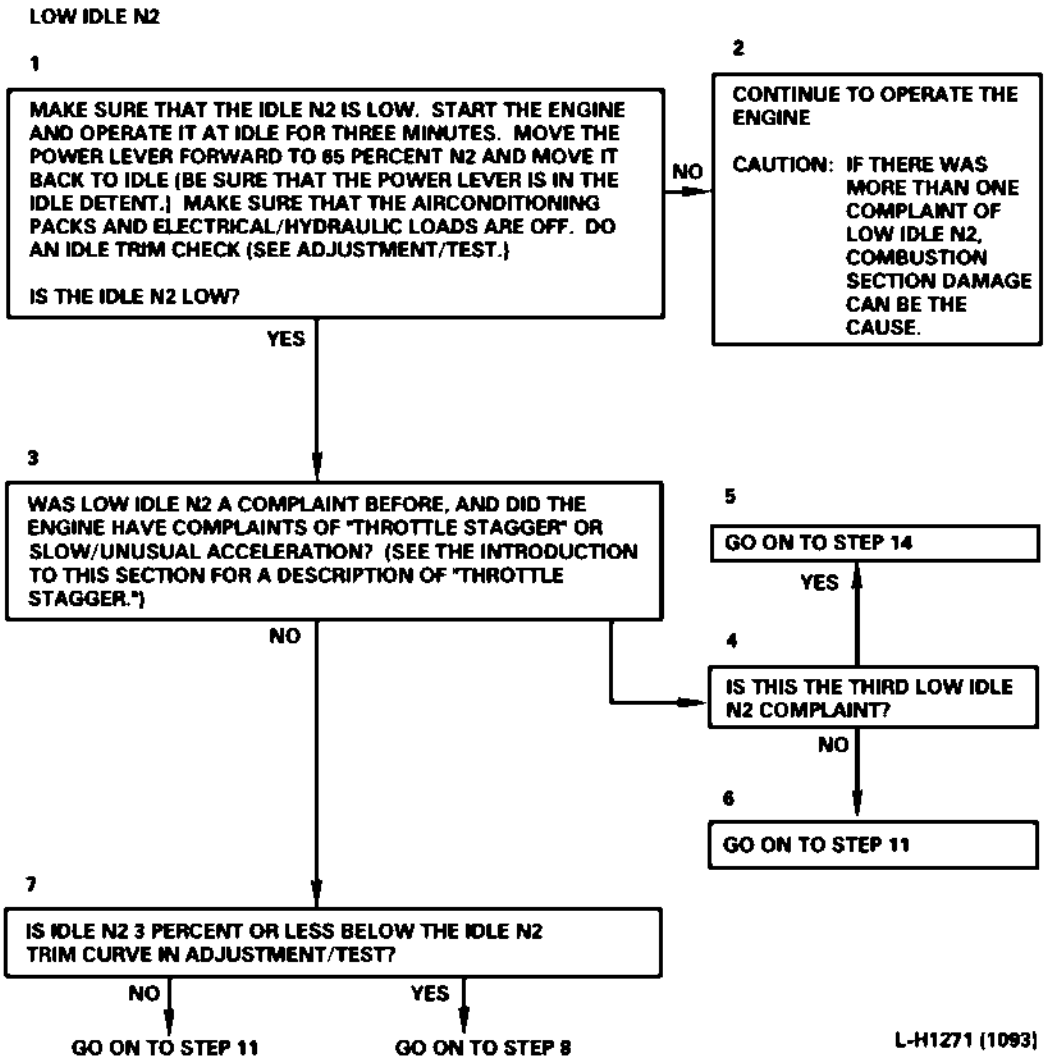
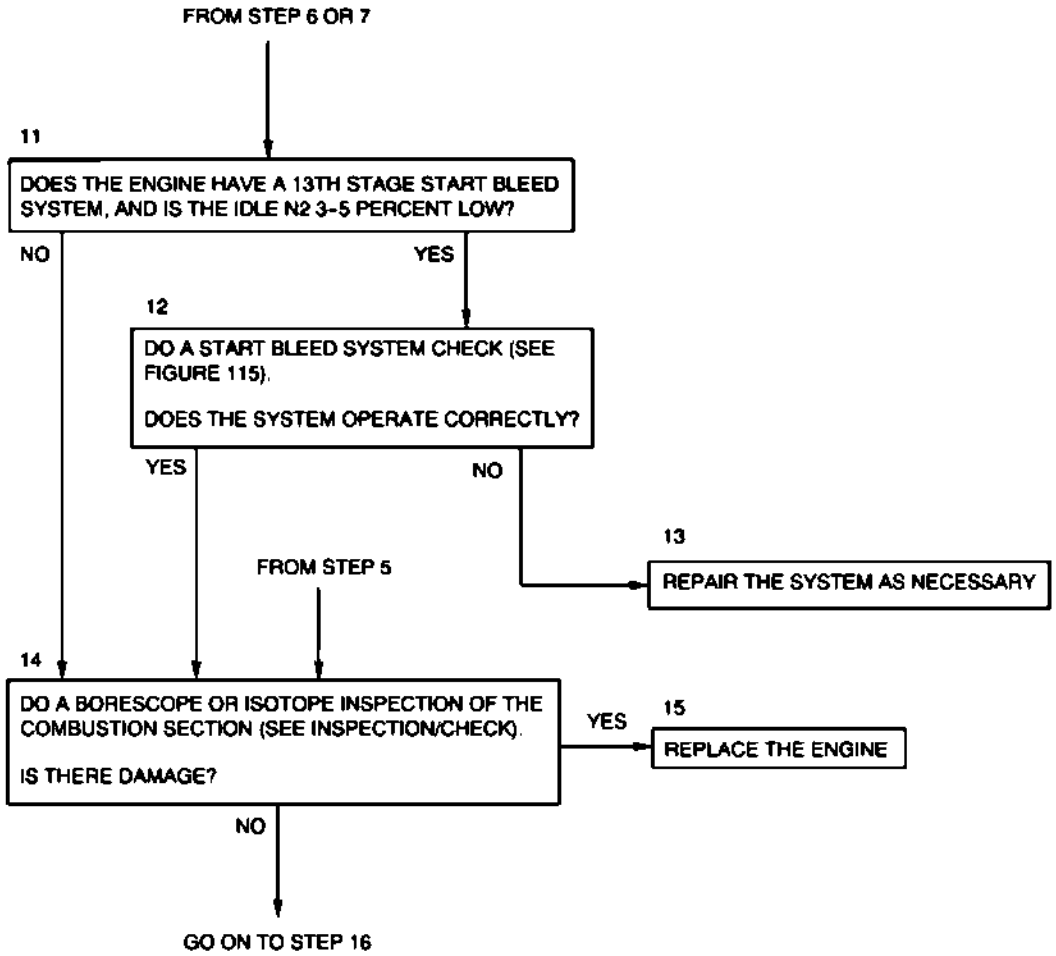

LOW IDLE N2
1
MAKE SURE THAT THE IDLE N2 IS LOW. START THE ENGINE AND OPERATE IT AT IDLE FOR THREE MINUTES. MOVE THE POWER LEVER FORWARD TO 65 PERCENT N2 AND MOVE IT BACK TO IDLE (BE SURE THAT THE POWER LEVER IS IN THE IDLE DETENT.) MAKE SURE THAT THE AIRCONDITIONING PACKS AND ELECTRICAL/HYDRAULIC LOADS ARE OFF. DO AN IDLE TRIM CHECK (SEE ADJUSTMENT/TEST.)
IS THE IDLE N2 LOW?
NO
2
CONTINUE TO OPERATE THE ENGINE
CAUTION: IF THERE WAS MORE THAN ONE COMPLAINT OF LOW IDLE N2, COMBUSTION SECTION DAMAGE CAN BE THE CAUSE.
YES
3
WAS LOW IDLE N2 A COMPLAINT BEFORE, AND DID THE ENGINE HAVE COMPLAINTS OF "THROTTLE STAGGER" OR SLOW/UNUSUAL ACCELERATION? (SEE THE INTRODUCTION TO THIS SECTION FOR A DESCRIPTION OF "THROTTLE STAGGER.")
NO
5
GO ON TO STEP 14
YES
4
IS THIS THE THIRD LOW IDLE N2 COMPLAINT?
NO
6
GO ON TO STEP 11
7
IS IDLE N2 3 PERCENT OR LESS BELOW THE IDLE N2 TRIM CURVE IN ADJUSTMENT/TEST?
NO
GO ON TO STEP 11
YES
GO ON TO STEP 8
L-H1271 (1093)

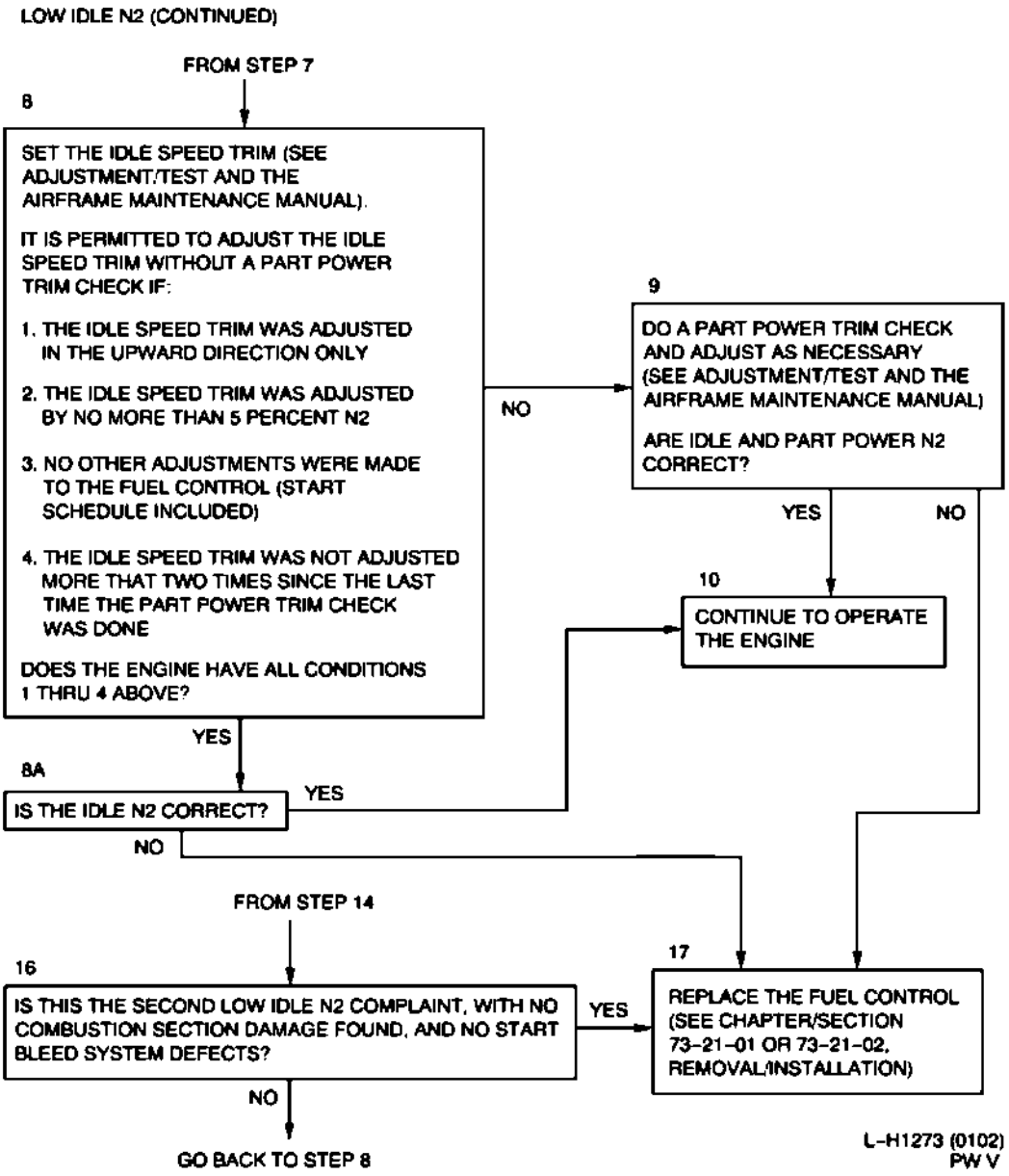
R Low Idle N2 Troubleshooting
R Figure 101 (Sheet 1)
(Task 72-00-00-810-006)

LOW IDLE N2 (CONTINUED)



L-H1272 (0102)
PW V

Low Idle N2 Troubleshooting
Figure 101 (Sheet 2)
(Task 72-00-00-810-006)


LOW IDLE N2 (CONTINUED)
FROM STEP 7
8
SET THE IDLE SPEED TRIM (SEE ADJUSTMENT/TEST AND THE AIRFRAME MAINTENANCE MANUAL).
IT IS PERMITTED TO ADJUST THE IDLE SPEED TRIM WITHOUT A PART POWER TRIM CHECK IF:
1. THE IDLE SPEED TRIM WAS ADJUSTED IN THE UPWARD DIRECTION ONLY
2. THE IDLE SPEED TRIM WAS ADJUSTED BY NO MORE THAN 5 PERCENT N2
3. NO OTHER ADJUSTMENTS WERE MADE TO THE FUEL CONTROL (START SCHEDULE INCLUDED)
4. THE IDLE SPEED TRIM WAS NOT ADJUSTED MORE THAT TWO TIMES SINCE THE LAST TIME THE PART POWER TRIM CHECK WAS DONE
DOES THE ENGINE HAVE ALL CONDITIONS 1 THRU 4 ABOVE?
NO
9
DO A PART POWER TRIM CHECK AND ADJUST AS NECESSARY (SEE ADJUSTMENT/TEST AND THE AIRFRAME MAINTENANCE MANUAL)
ARE IDLE AND PART POWER N2 CORRECT?
YES
NO
10
CONTINUE TO OPERATE THE ENGINE
YES
8A
IS THE IDLE N2 CORRECT?
YES
NO
FROM STEP 14
16
IS THIS THE SECOND LOW IDLE N2 COMPLAINT, WITH NO COMBUSTION SECTION DAMAGE FOUND, AND NO START BLEED SYSTEM DEFECTS?
YES
17
REPLACE THE FUEL CONTROL (SEE CHAPTER/SECTION 73-21-01 OR 73-21-02, REMOVAL/INSTALLATION)
NO
GO BACK TO STEP 8
L-H1273 (0102)
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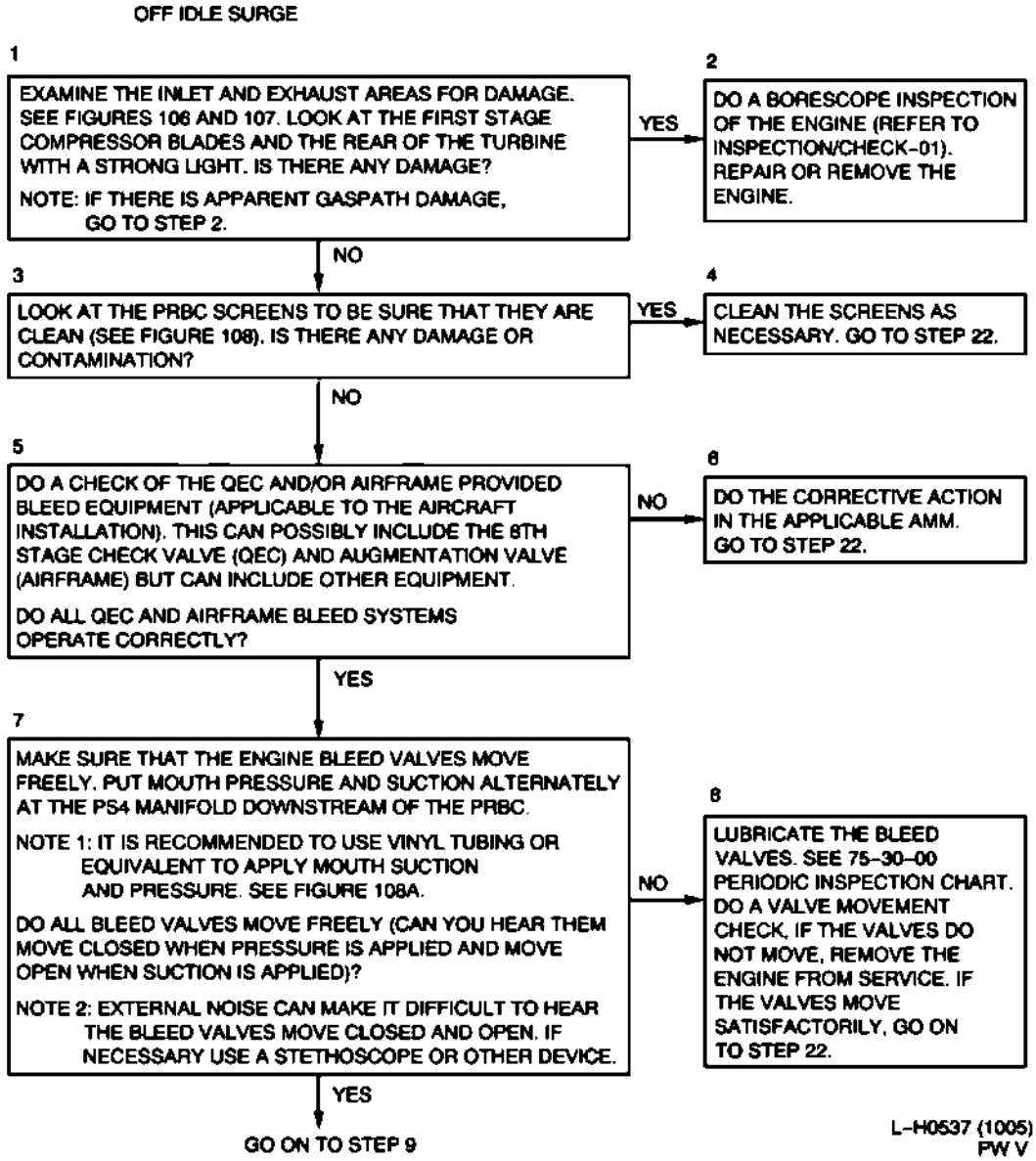
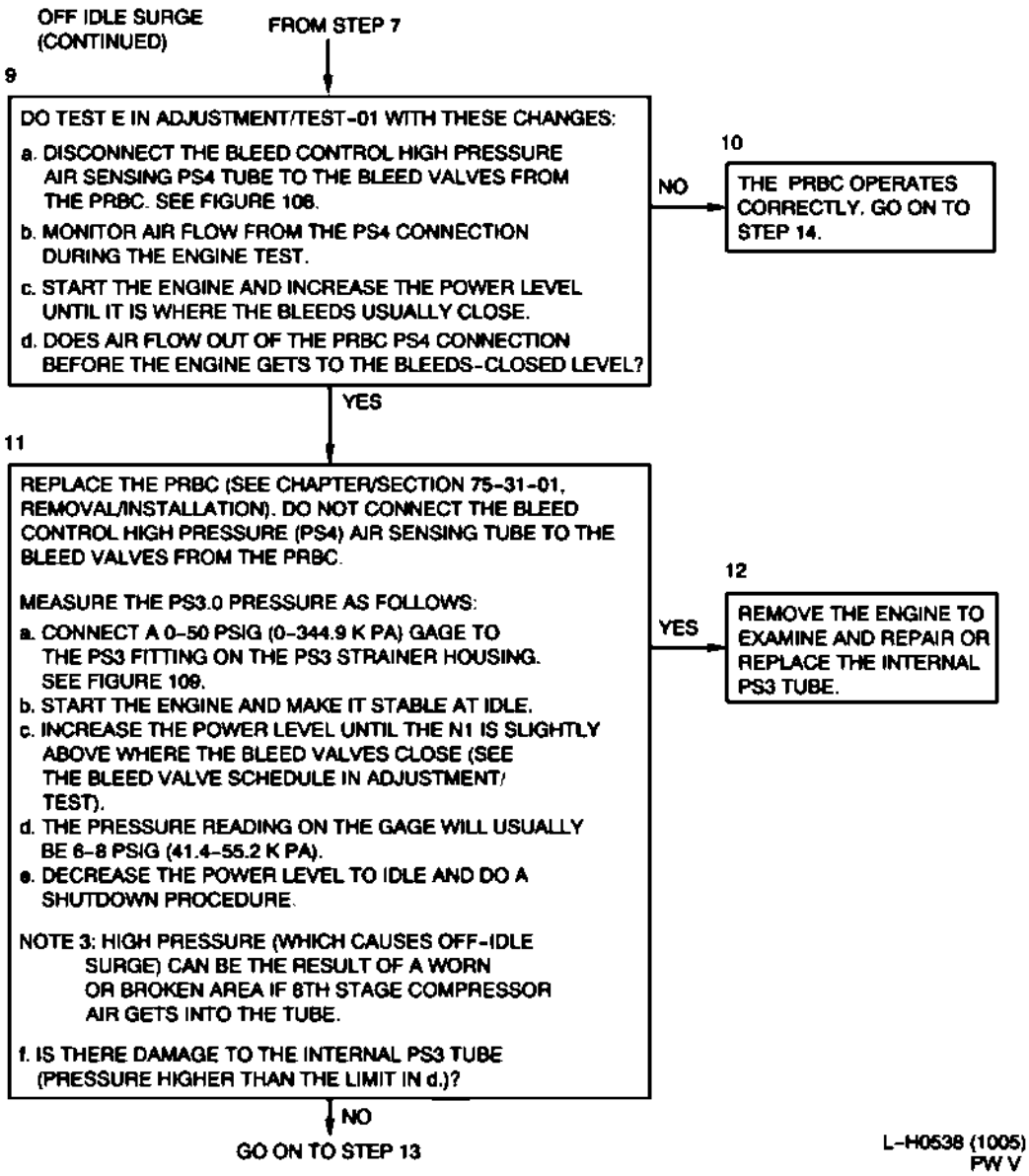
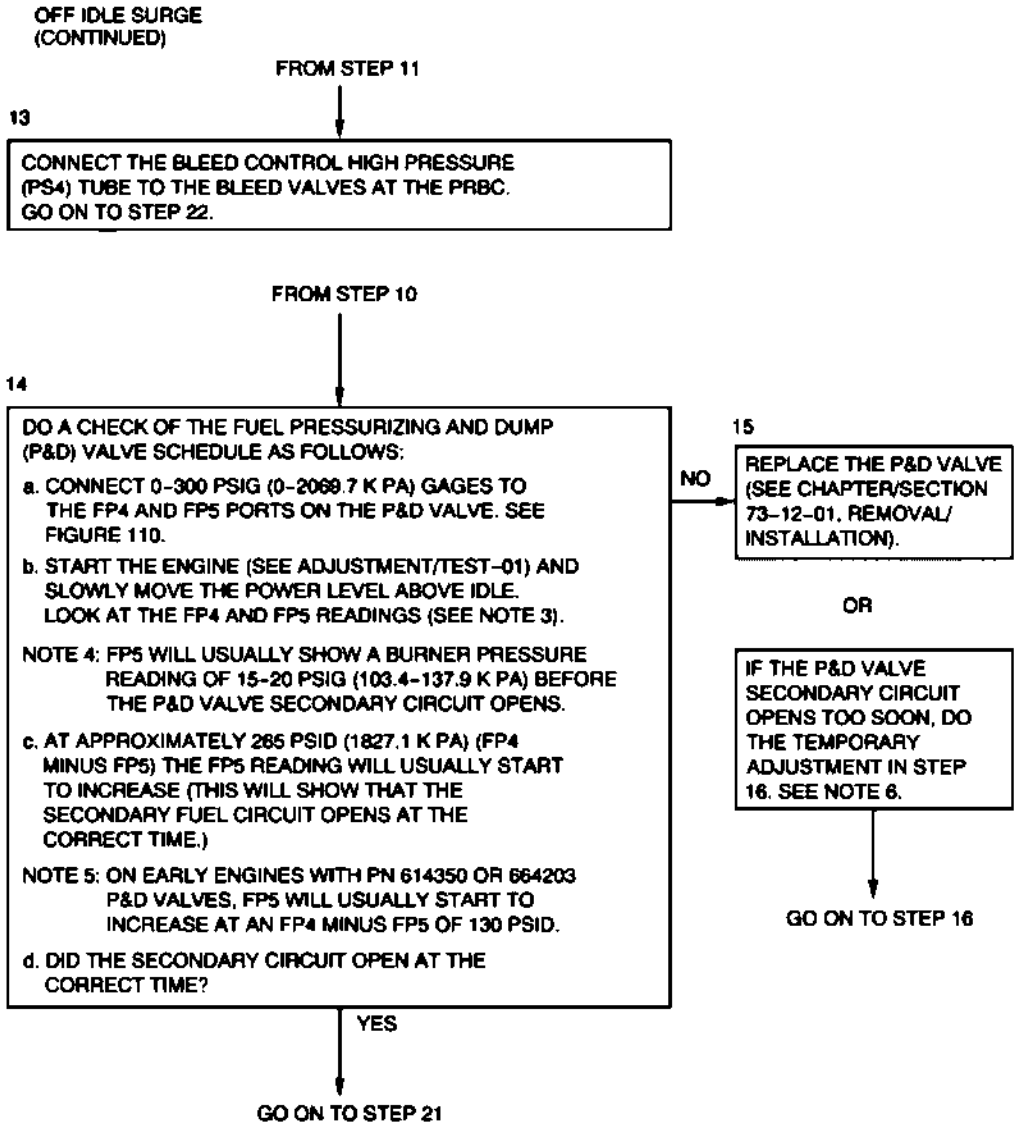
Low Idle N2 Troubleshooting
Figure 101 (Sheet 3)
(Task 72-00-00-810-006)


OFF IDLE SURGE
1
EXAMINE THE INLET AND EXHAUST AREAS FOR DAMAGE. SEE FIGURES 106 AND 107. LOOK AT THE FIRST STAGE COMPRESSOR BLADES AND THE REAR OF THE TURBINE WITH A STRONG LIGHT. IS THERE ANY DAMAGE?
NOTE: IF THERE IS APPARENT GASPATH DAMAGE, GO TO STEP 2.
YES
2
DO A BORESCOPE INSPECTION OF THE ENGINE (REFER TO INSPECTION/CHECK-01). REPAIR OR REMOVE THE ENGINE.
NO
3
LOOK AT THE PRBC SCREENS TO BE SURE THAT THEY ARE CLEAN (SEE FIGURE 108). IS THERE ANY DAMAGE OR CONTAMINATION?
YES
4
CLEAN THE SCREENS AS NECESSARY. GO TO STEP 22.
NO
5
DO A CHECK OF THE QEC AND/OR AIRFRAME PROVIDED BLEED EQUIPMENT (APPLICABLE TO THE AIRCRAFT INSTALLATION). THIS CAN POSSIBLY INCLUDE THE 8TH STAGE CHECK VALVE (QEC) AND AUGMENTATION VALVE (AIRFRAME) BUT CAN INCLUDE OTHER EQUIPMENT.
DO ALL QEC AND AIRFRAME BLEED SYSTEMS OPERATE CORRECTLY?
NO
6
DO THE CORRECTIVE ACTION IN THE APPLICABLE AMM. GO TO STEP 22.
YES
7
MAKE SURE THAT THE ENGINE BLEED VALVES MOVE FREELY. PUT MOUTH PRESSURE AND SUCTION ALTERNATELY AT THE PS4 MANIFOLD DOWNSTREAM OF THE PRBC.
NOTE 1: IT IS RECOMMENDED TO USE VINYL TUBING OR EQUIVALENT TO APPLY MOUTH SUCTION AND PRESSURE. SEE FIGURE 108A.
DO ALL BLEED VALVES MOVE FREELY (CAN YOU HEAR THEM MOVE CLOSED WHEN PRESSURE IS APPLIED AND MOVE OPEN WHEN SUCTION IS APPLIED)?
NOTE 2: EXTERNAL NOISE CAN MAKE IT DIFFICULT TO HEAR THE BLEED VALVES MOVE CLOSED AND OPEN. IF NECESSARY USE A STETHOSCOPE OR OTHER DEVICE.
NO
8
LUBRICATE THE BLEED VALVES. SEE 75-30-00 PERIODIC INSPECTION CHART. DO A VALVE MOVEMENT CHECK. IF THE VALVES DO NOT MOVE, REMOVE THE ENGINE FROM SERVICE. IF THE VALVES MOVE SATISFACTORILY, GO ON TO STEP 22.
YES
GO ON TO STEP 9
L-H0537 (1005)
PW V

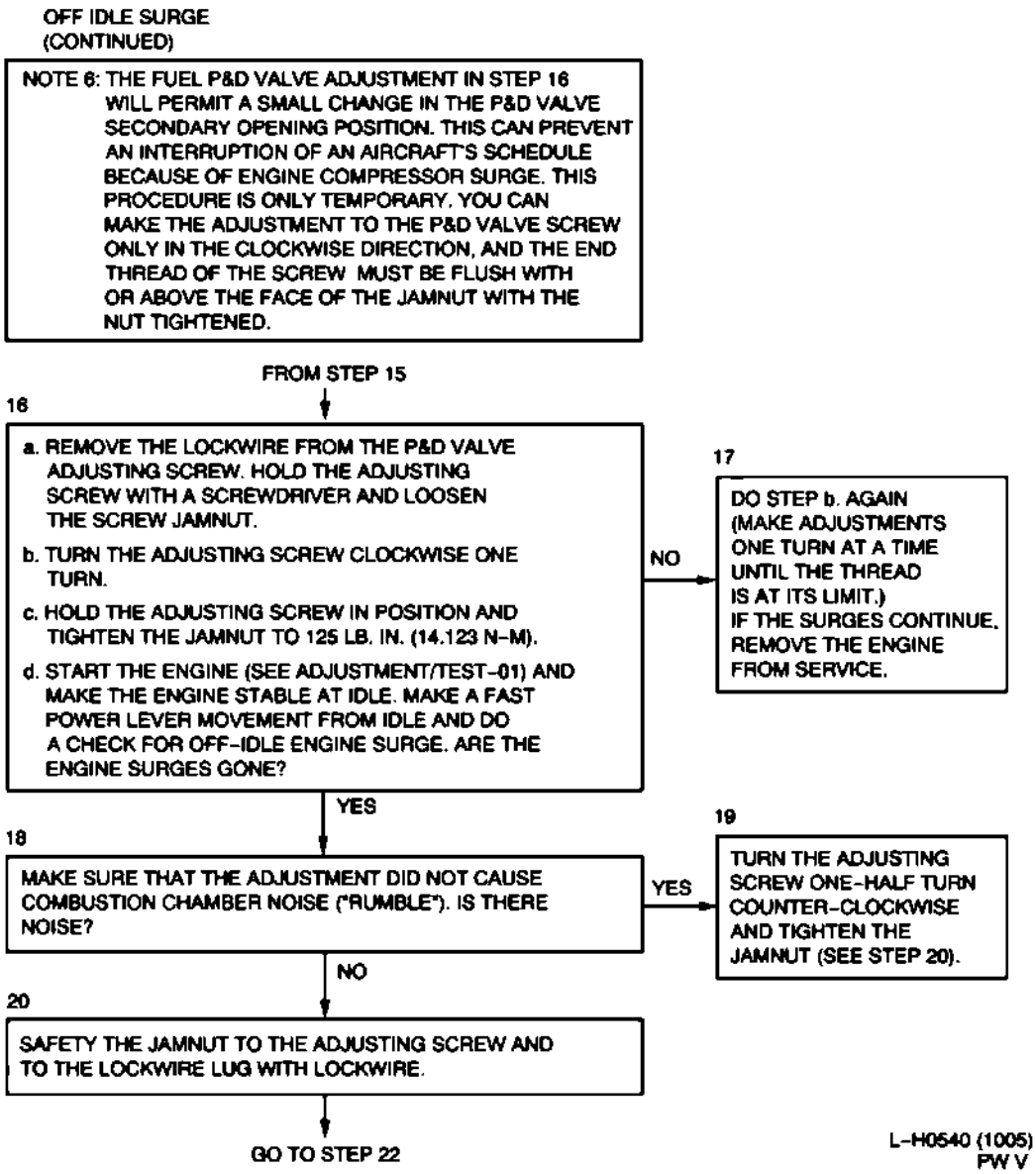
Off-Idle Surge Troubleshooting
Figure 102 (Sheet 1)
(Task 72-00-00-810-006)


OFF IDLE SURGE
(CONTINUED)
FROM STEP 7
9
DO TEST E IN ADJUSTMENT/TEST-01 WITH THESE CHANGES:
a. DISCONNECT THE BLEED CONTROL HIGH PRESSURE AIR SENSING PS4 TUBE TO THE BLEED VALVES FROM THE PRBC. SEE FIGURE 108.
b. MONITOR AIR FLOW FROM THE PS4 CONNECTION DURING THE ENGINE TEST.
c. START THE ENGINE AND INCREASE THE POWER LEVEL UNTIL IT IS WHERE THE BLEEDS USUALLY CLOSE.
d. DOES AIR FLOW OUT OF THE PRBC PS4 CONNECTION BEFORE THE ENGINE GETS TO THE BLEEDS-CLOSED LEVEL?
NO
10
THE PRBC OPERATES CORRECTLY. GO ON TO STEP 14.
YES
11
REPLACE THE PRBC (SEE CHAPTER/SECTION 75-31-01, REMOVAL/INSTALLATION). DO NOT CONNECT THE BLEED CONTROL HIGH PRESSURE (PS4) AIR SENSING TUBE TO THE BLEED VALVES FROM THE PRBC.
MEASURE THE PS3.0 PRESSURE AS FOLLOWS:
a. CONNECT A 0-50 PSIG (0-344.9 K PA) GAGE TO THE PS3 FITTING ON THE PS3 STRAINER HOUSING. SEE FIGURE 109.
b. START THE ENGINE AND MAKE IT STABLE AT IDLE.
c. INCREASE THE POWER LEVEL UNTIL THE N1 IS SLIGHTLY ABOVE WHERE THE BLEED VALVES CLOSE (SEE THE BLEED VALVE SCHEDULE IN ADJUSTMENT/TEST).
d. THE PRESSURE READING ON THE GAGE WILL USUALLY BE 6-8 PSIG (41.4-55.2 K PA).
e. DECREASE THE POWER LEVEL TO IDLE AND DO A SHUTDOWN PROCEDURE.
NOTE 3: HIGH PRESSURE (WHICH CAUSES OFF-IDLE SURGE) CAN BE THE RESULT OF A WORN OR BROKEN AREA IF 8TH STAGE COMPRESSOR AIR GETS INTO THE TUBE.
f. IS THERE DAMAGE TO THE INTERNAL PS3 TUBE (PRESSURE HIGHER THAN THE LIMIT IN d.)?
YES
12
REMOVE THE ENGINE TO EXAMINE AND REPAIR OR REPLACE THE INTERNAL PS3 TUBE.
NO
GO ON TO STEP 13
L-H0538 (1005)
PW V

Off-Idle Surge Troubleshooting
Figure 102 (Sheet 2)
(Task 72-00-00-810-006)

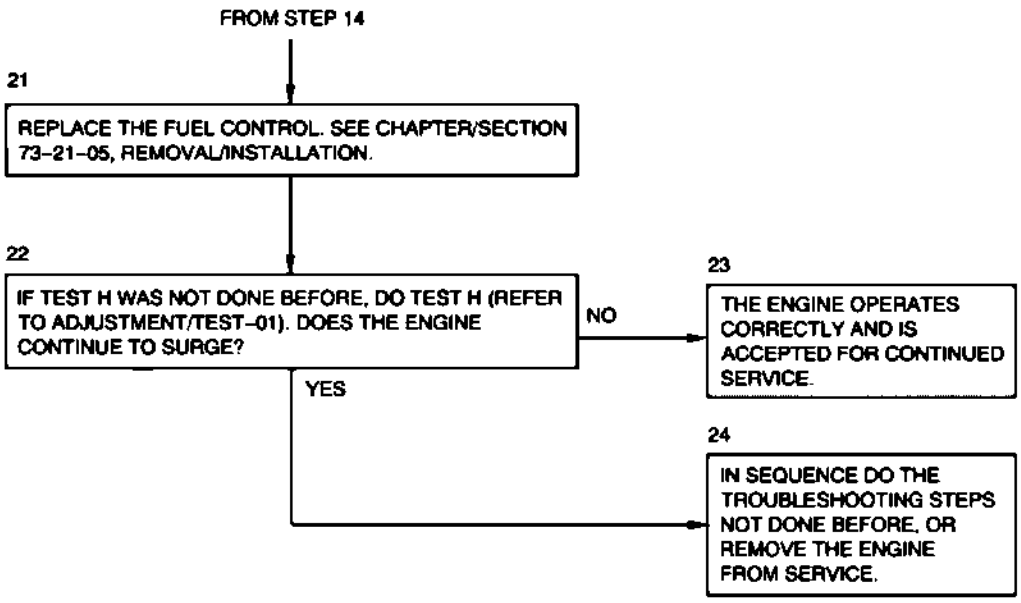

OFF IDLE SURGE
(CONTINUED)
FROM STEP 11
13
CONNECT THE BLEED CONTROL HIGH PRESSURE (PS4) TUBE TO THE BLEED VALVES AT THE PRBC. GO ON TO STEP 22.
FROM STEP 10
14
DO A CHECK OF THE FUEL PRESSURIZING AND DUMP (P&D) VALVE SCHEDULE AS FOLLOWS:
a. CONNECT 0-300 PSIG (0-2069.7 K PA) GAGES TO THE FP4 AND FP5 PORTS ON THE P&D VALVE. SEE FIGURE 110.
b. START THE ENGINE (SEE ADJUSTMENT/TEST-01) AND SLOWLY MOVE THE POWER LEVEL ABOVE IDLE. LOOK AT THE FP4 AND FP5 READINGS (SEE NOTE 3).
NOTE 4: FP5 WILL USUALLY SHOW A BURNER PRESSURE READING OF 15-20 PSIG (103.4-137.9 K PA) BEFORE THE P&D VALVE SECONDARY CIRCUIT OPENS.
c. AT APPROXIMATELY 265 PSID (1827.1 K PA) (FP4 MINUS FP5) THE FP5 READING WILL USUALLY START TO INCREASE (THIS WILL SHOW THAT THE SECONDARY FUEL CIRCUIT OPENS AT THE CORRECT TIME.)
NOTE 5: ON EARLY ENGINES WITH PN 614350 OR 664203 P&D VALVES, FP5 WILL USUALLY START TO INCREASE AT AN FP4 MINUS FP5 OF 130 PSID.
d. DID THE SECONDARY CIRCUIT OPEN AT THE CORRECT TIME?
YES
GO ON TO STEP 21
NO
15
REPLACE THE P&D VALVE (SEE CHAPTER/SECTION 73-12-01, REMOVAL/ INSTALLATION).
OR
IF THE P&D VALVE SECONDARY CIRCUIT OPENS TOO SOON, DO THE TEMPORARY ADJUSTMENT IN STEP 16. SEE NOTE 6.
GO ON TO STEP 16
L-H0539 (1005)
PW V

Off-Idle Surge Troubleshooting
Figure 102 (Sheet 3)
(Task 72-00-00-810-006)


OFF IDLE SURGE
(CONTINUED)
NOTE 6: THE FUEL P&D VALVE ADJUSTMENT IN STEP 16 WILL PERMIT A SMALL CHANGE IN THE P&D VALVE SECONDARY OPENING POSITION. THIS CAN PREVENT AN INTERRUPTION OF AN AIRCRAFT'S SCHEDULE BECAUSE OF ENGINE COMPRESSOR SURGE. THIS PROCEDURE IS ONLY TEMPORARY. YOU CAN MAKE THE ADJUSTMENT TO THE P&D VALVE SCREW ONLY IN THE CLOCKWISE DIRECTION, AND THE END THREAD OF THE SCREW MUST BE FLUSH WITH OR ABOVE THE FACE OF THE JAMNUT WITH THE NUT TIGHTENED.
FROM STEP 15
16
a. REMOVE THE LOCKWIRE FROM THE P&D VALVE ADJUSTING SCREW. HOLD THE ADJUSTING SCREW WITH A SCREWDRIVER AND LOOSEN THE SCREW JAMNUT.
b. TURN THE ADJUSTING SCREW CLOCKWISE ONE TURN.
c. HOLD THE ADJUSTING SCREW IN POSITION AND TIGHTEN THE JAMNUT TO 125 LB. IN. (14.123 N-M).
d. START THE ENGINE (SEE ADJUSTMENT/TEST-01) AND MAKE THE ENGINE STABLE AT IDLE. MAKE A FAST POWER LEVER MOVEMENT FROM IDLE AND DO A CHECK FOR OFF-IDLE ENGINE SURGE. ARE THE ENGINE SURGES GONE?
NO
17
DO STEP b. AGAIN (MAKE ADJUSTMENTS ONE TURN AT A TIME UNTIL THE THREAD IS AT ITS LIMIT.) IF THE SURGES CONTINUE, REMOVE THE ENGINE FROM SERVICE.
YES
18
MAKE SURE THAT THE ADJUSTMENT DID NOT CAUSE COMBUSTION CHAMBER NOISE ("RUMBLE"). IS THERE NOISE?
YES
19
TURN THE ADJUSTING SCREW ONE-HALF TURN COUNTER-CLOCKWISE AND TIGHTEN THE JAMNUT (SEE STEP 20).
NO
20
SAFETY THE JAMNUT TO THE ADJUSTING SCREW AND TO THE LOCKWIRE LUG WITH LOCKWIRE.
GO TO STEP 22
L-H0540 (1005)
PW V

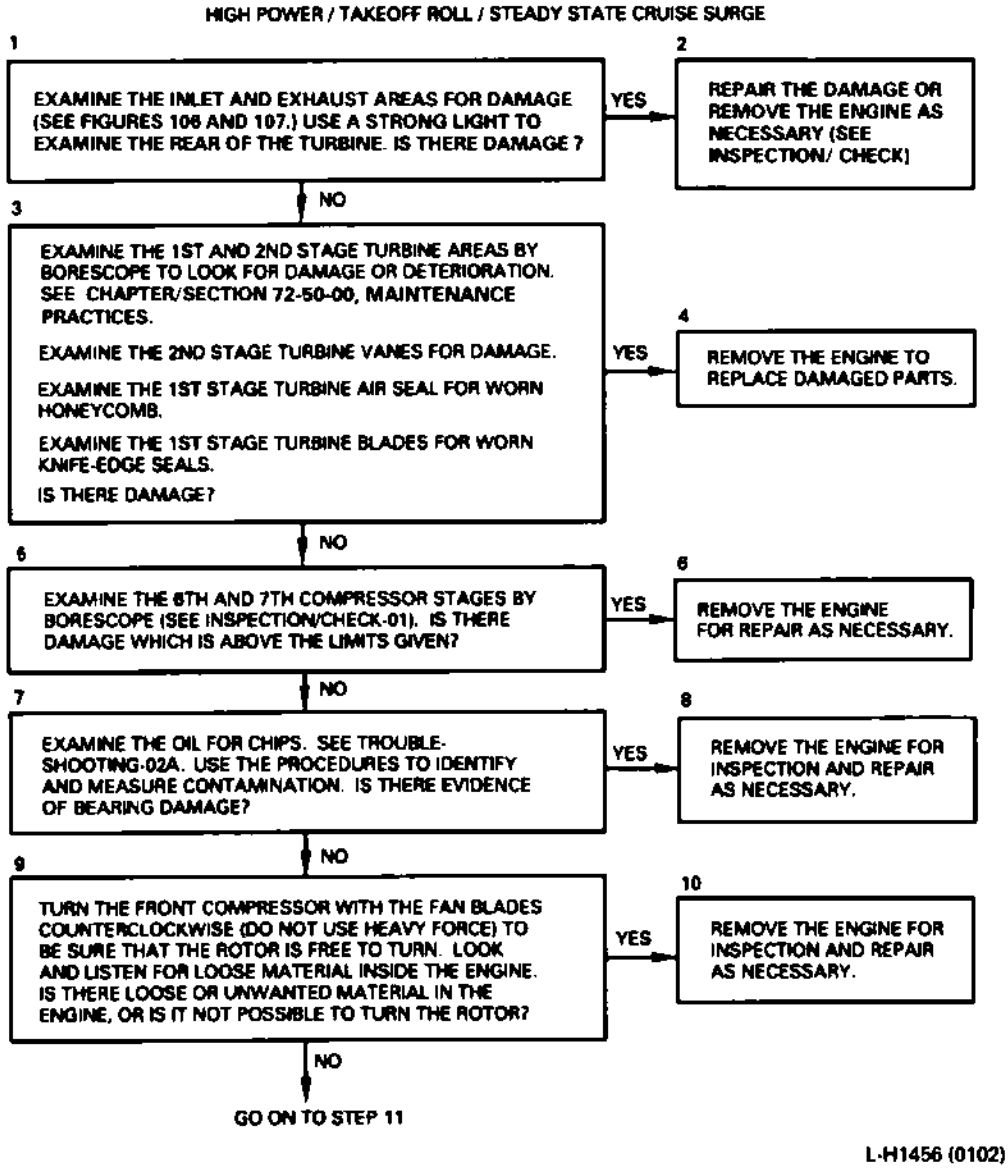
Off-Idle Surge Troubleshooting
Figure 102 (Sheet 4)
(Task 72-00-00-810-006)

OFF IDLE SURGE
(CONTINUED)


FROM STEP 14
21
REPLACE THE FUEL CONTROL. SEE CHAPTER/SECTION 73-21-05, REMOVAL/INSTALLATION.
22
IF TEST H WAS NOT DONE BEFORE, DO TEST H (REFER TO ADJUSTMENT/TEST-01). DOES THE ENGINE CONTINUE TO SURGE?
NO
23
THE ENGINE OPERATES CORRECTLY AND IS ACCEPTED FOR CONTINUED SERVICE.
YES
24
IN SEQUENCE DO THE TROUBLESHOOTING STEPS NOT DONE BEFORE, OR REMOVE THE ENGINE FROM SERVICE.

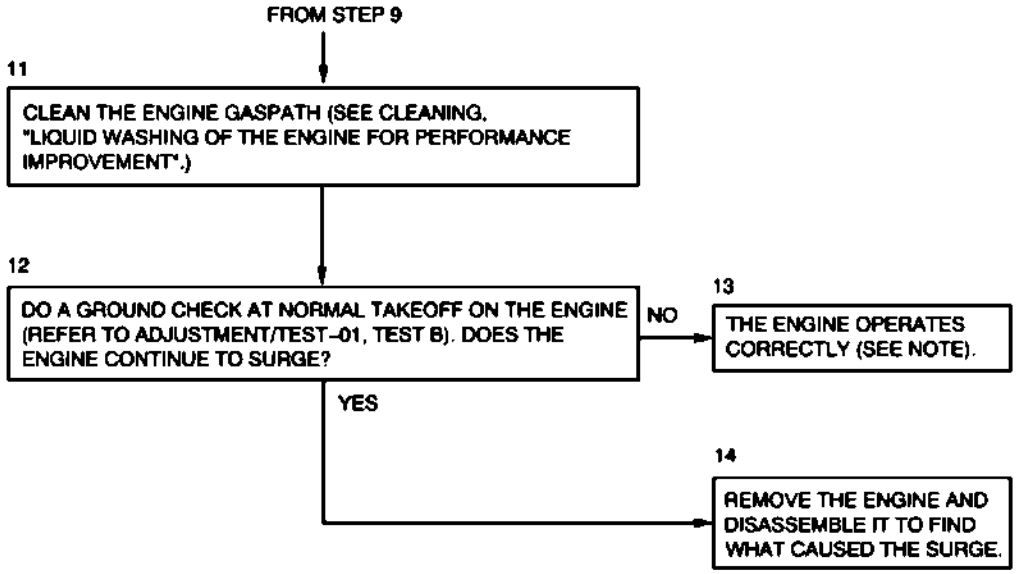
L-H0541 (1005)
PW V

Off-Idle Surge Troubleshooting
Figure 102 (Sheet 5)
(Task 72-00-00-810-006)


HIGH POWER / TAKEOFF ROLL / STEADY STATE CRUISE SURGE
1
EXAMINE THE INLET AND EXHAUST AREAS FOR DAMAGE (SEE FIGURES 106 AND 107.) USE A STRONG LIGHT TO EXAMINE THE REAR OF THE TURBINE. IS THERE DAMAGE ?
YES
2
REPAIR THE DAMAGE OR REMOVE THE ENGINE AS NECESSARY (SEE INSPECTION/ CHECK)
NO
3
EXAMINE THE 1ST AND 2ND STAGE TURBINE AREAS BY BORESCOPE TO LOOK FOR DAMAGE OR DETERIORATION. SEE CHAPTER/SECTION 72-50-00, MAINTENANCE PRACTICES.
EXAMINE THE 2ND STAGE TURBINE VANES FOR DAMAGE.
EXAMINE THE 1ST STAGE TURBINE AIR SEAL FOR WORN HONEYCOMB.
EXAMINE THE 1ST STAGE TURBINE BLADES FOR WORN KNIFE-EDGE SEALS.
IS THERE DAMAGE?
YES
4
REMOVE THE ENGINE TO REPLACE DAMAGED PARTS.
NO
5
EXAMINE THE 6TH AND 7TH COMPRESSOR STAGES BY BORESCOPE (SEE INSPECTION/CHECK-01). IS THERE DAMAGE WHICH IS ABOVE THE LIMITS GIVEN?
YES
6
REMOVE THE ENGINE FOR REPAIR AS NECESSARY.
NO
7
EXAMINE THE OIL FOR CHIPS. SEE TROUBLE-SHOOTING-02A. USE THE PROCEDURES TO IDENTIFY AND MEASURE CONTAMINATION. IS THERE EVIDENCE OF BEARING DAMAGE?
YES
8
REMOVE THE ENGINE FOR INSPECTION AND REPAIR AS NECESSARY.
NO
9
TURN THE FRONT COMPRESSOR WITH THE FAN BLADES COUNTERCLOCKWISE (DO NOT USE HEAVY FORCE) TO BE SURE THAT THE ROTOR IS FREE TO TURN. LOOK AND LISTEN FOR LOOSE MATERIAL INSIDE THE ENGINE. IS THERE LOOSE OR UNWANTED MATERIAL IN THE ENGINE, OR IS IT NOT POSSIBLE TO TURN THE ROTOR?
YES
10
REMOVE THE ENGINE FOR INSPECTION AND REPAIR AS NECESSARY.
NO
GO ON TO STEP 11
L-H1456 (0102)

High Power/Takeoff Roll/Steady
State Cruise Surge Troubleshooting
Figure 103 (Sheet 1)
(Task 72-00-00-810-006)

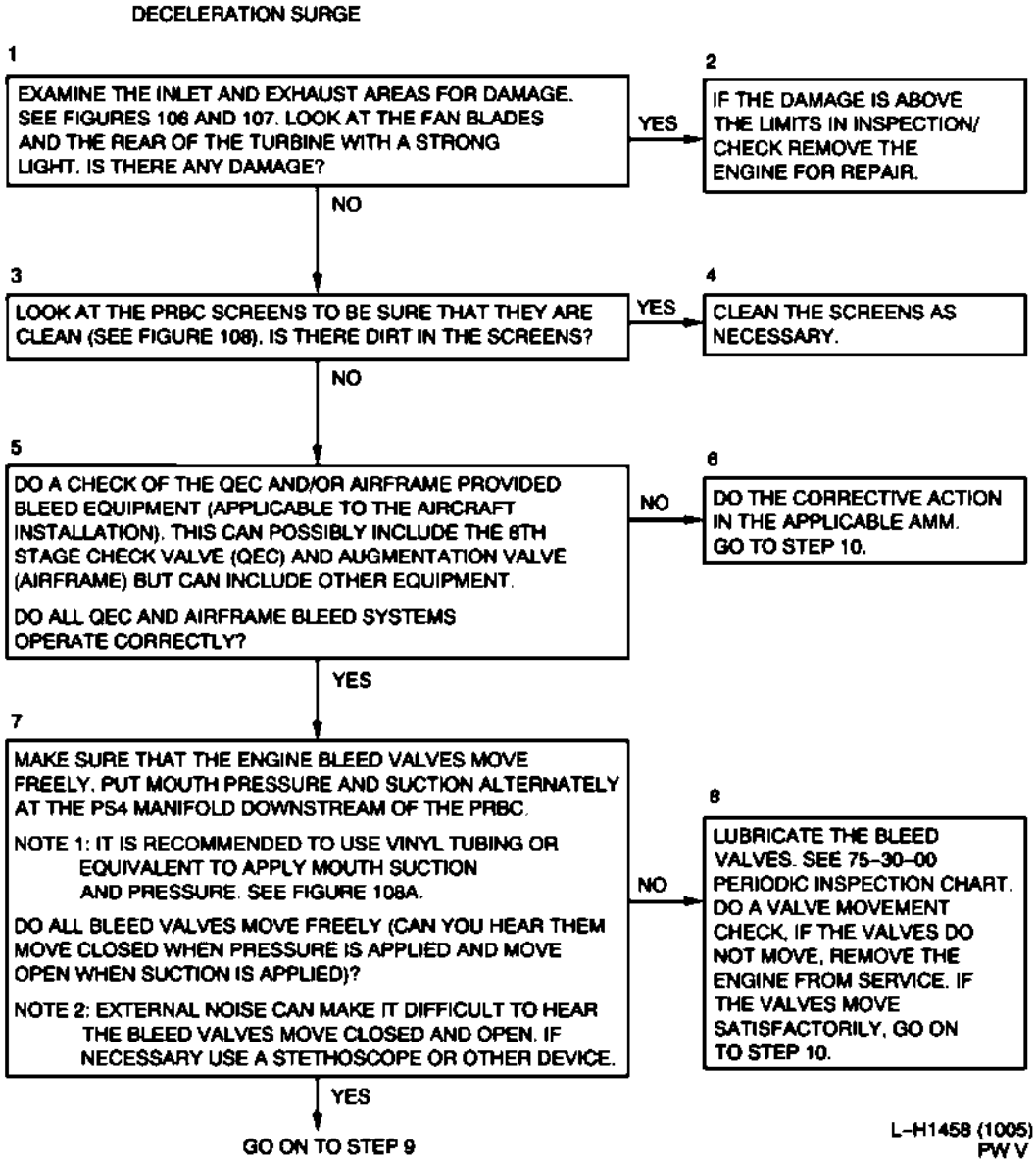
HIGH POWER / TAKEOFF ROLL / STEADY STATE CRUISE SURGE (CONTINUED)


FROM STEP 9
11
CLEAN THE ENGINE GASPATH (SEE CLEANING, "LIQUID WASHING OF THE ENGINE FOR PERFORMANCE IMPROVEMENT".)
12
DO A GROUND CHECK AT NORMAL TAKEOFF ON THE ENGINE (REFER TO ADJUSTMENT/TEST-01, TEST B). DOES THE ENGINE CONTINUE TO SURGE?
NO
13
THE ENGINE OPERATES CORRECTLY (SEE NOTE).
YES
14
REMOVE THE ENGINE AND DISASSEMBLE IT TO FIND WHAT CAUSED THE SURGE.

NOTE: IF SOFT OBJECTS GO INTO THE ENGINE, THIS CAN CAUSE A SURGE WITHOUT DAMAGE TO THE ENGINE. THIS OCCURS WHEN THE MATERIAL (PAPER, PLASTIC SHEETS, SNOW OR ICE) STAYS ON THE INLET CASE VANES AND CAUSES INLET AIRFLOW DISTORTION. THIS ALSO OCCURS WHEN WATER OR SNOW GOES INTO THE ENGINE. CLEAR AIR TURBULENCE, OR DIRT ON THE BLADES AND VANES CAN ALSO CAUSE THIS TYPE OF SURGE.

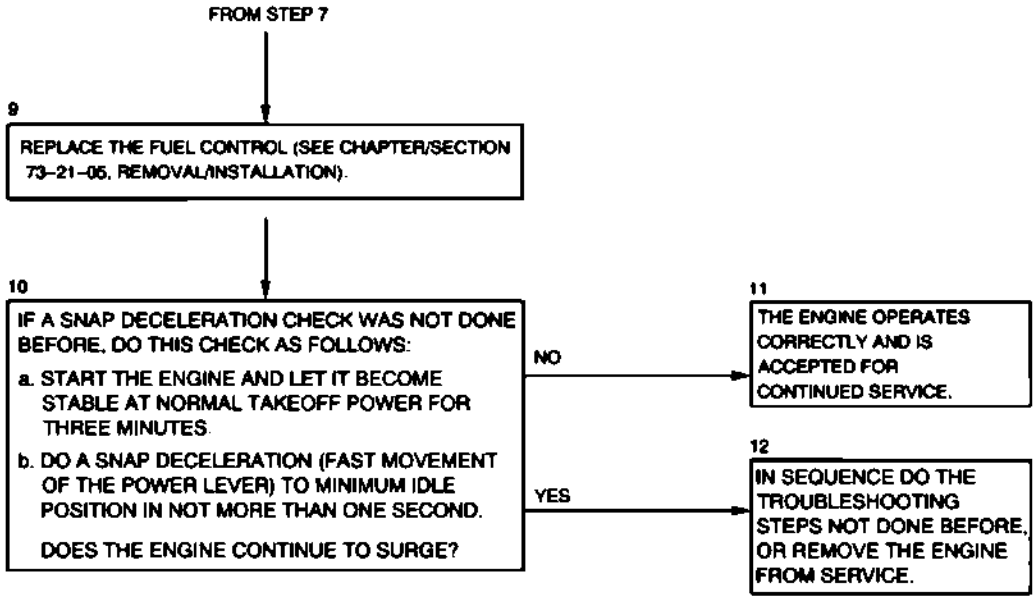
L-H1457 (1005)
PW V

High Power/Takeoff Roll/Steady
State Cruise Surge Troubleshooting
Figure 103 (Sheet 2)
(Task 72-00-00-810-006)


DECELERATION SURGE
1
EXAMINE THE INLET AND EXHAUST AREAS FOR DAMAGE. SEE FIGURES 106 AND 107. LOOK AT THE FAN BLADES AND THE REAR OF THE TURBINE WITH A STRONG LIGHT. IS THERE ANY DAMAGE?
YES
2
IF THE DAMAGE IS ABOVE THE LIMITS IN INSPECTION/ CHECK REMOVE THE ENGINE FOR REPAIR.
NO
3
LOOK AT THE PRBC SCREENS TO BE SURE THAT THEY ARE CLEAN (SEE FIGURE 108). IS THERE DIRT IN THE SCREENS?
YES
4
CLEAN THE SCREENS AS NECESSARY.
NO
5
DO A CHECK OF THE QEC AND/OR AIRFRAME PROVIDED BLEED EQUIPMENT (APPLICABLE TO THE AIRCRAFT INSTALLATION). THIS CAN POSSIBLY INCLUDE THE 8TH STAGE CHECK VALVE (QEC) AND AUGMENTATION VALVE (AIRFRAME) BUT CAN INCLUDE OTHER EQUIPMENT.
DO ALL QEC AND AIRFRAME BLEED SYSTEMS OPERATE CORRECTLY?
NO
6
DO THE CORRECTIVE ACTION IN THE APPLICABLE AMM. GO TO STEP 10.
YES
7
MAKE SURE THAT THE ENGINE BLEED VALVES MOVE FREELY. PUT MOUTH PRESSURE AND SUCTION ALTERNATELY AT THE PS4 MANIFOLD DOWNSTREAM OF THE PRBC.
NOTE 1: IT IS RECOMMENDED TO USE VINYL TUBING OR EQUIVALENT TO APPLY MOUTH SUCTION AND PRESSURE. SEE FIGURE 108A.
DO ALL BLEED VALVES MOVE FREELY (CAN YOU HEAR THEM MOVE CLOSED WHEN PRESSURE IS APPLIED AND MOVE OPEN WHEN SUCTION IS APPLIED)?
NOTE 2: EXTERNAL NOISE CAN MAKE IT DIFFICULT TO HEAR THE BLEED VALVES MOVE CLOSED AND OPEN. IF NECESSARY USE A STETHOSCOPE OR OTHER DEVICE.
NO
8
LUBRICATE THE BLEED VALVES. SEE 75-30-00 PERIODIC INSPECTION CHART. DO A VALVE MOVEMENT CHECK. IF THE VALVES DO NOT MOVE, REMOVE THE ENGINE FROM SERVICE. IF THE VALVES MOVE SATISFACTORILY, GO ON TO STEP 10.
YES
GO ON TO STEP 9
L-H1458 (1005)
PW V

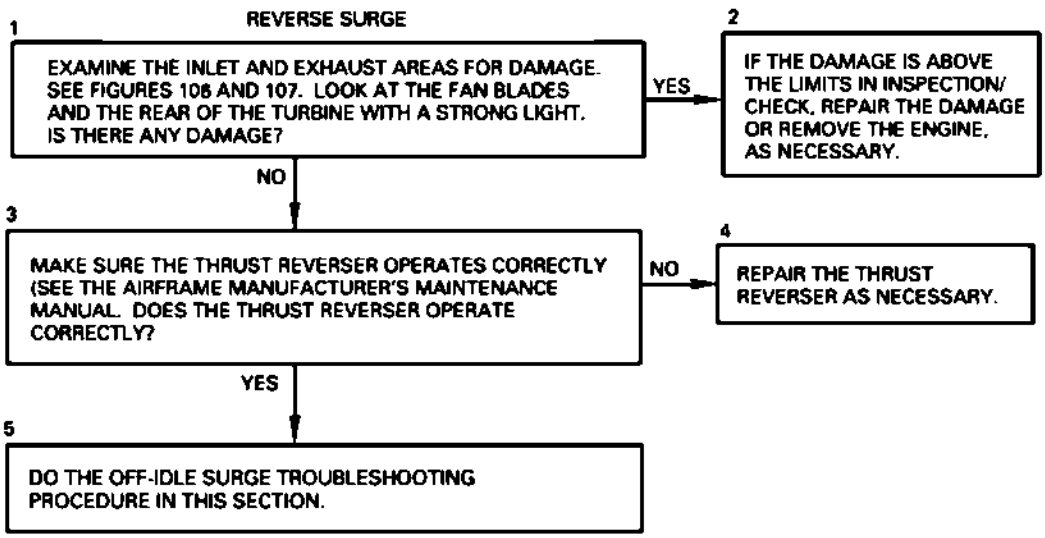
Deceleration Surge Troubleshooting
Figure 104 (Sheet 1)
(Task 72-00-00-810-006)

DECELERATION SURGE (CONTINUED)


FROM STEP 7
9
REPLACE THE FUEL CONTROL (SEE CHAPTER/SECTION 73-21-05, REMOVAL/INSTALLATION).
10
IF A SNAP DECELERATION CHECK WAS NOT DONE BEFORE, DO THIS CHECK AS FOLLOWS:
a. START THE ENGINE AND LET IT BECOME STABLE AT NORMAL TAKEOFF POWER FOR THREE MINUTES.
b. DO A SNAP DECELERATION (FAST MOVEMENT OF THE POWER LEVER) TO MINIMUM IDLE POSITION IN NOT MORE THAN ONE SECOND.
DOES THE ENGINE CONTINUE TO SURGE?
NO
11
THE ENGINE OPERATES CORRECTLY AND IS ACCEPTED FOR CONTINUED SERVICE.
YES
12
IN SEQUENCE DO THE TROUBLESHOOTING STEPS NOT DONE BEFORE, OR REMOVE THE ENGINE FROM SERVICE.

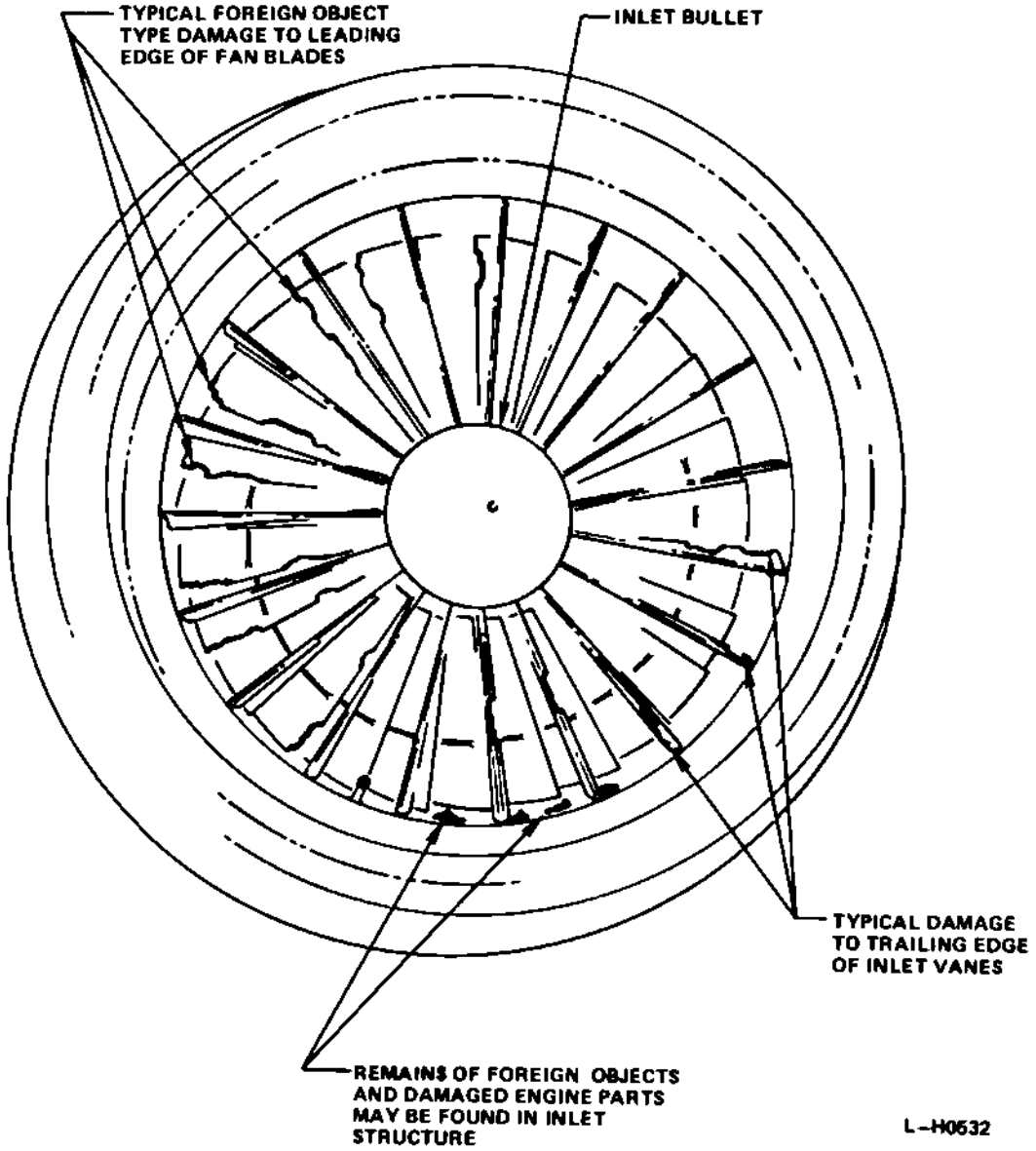
L-H7645 (1005)
PW V

Deceleration Surge Troubleshooting
Figure 104 (Sheet 2)
(Task 72-00-00-810-006)

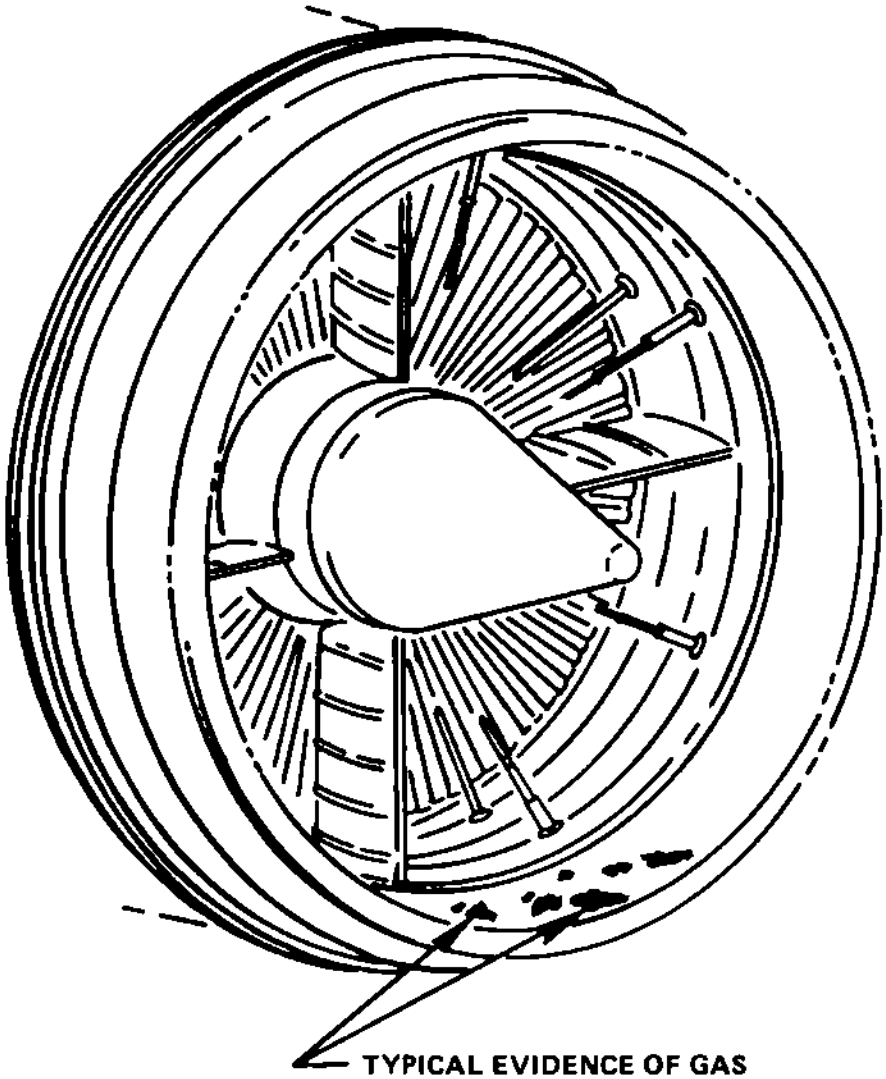

1
REVERSE SURGE
EXAMINE THE INLET AND EXHAUST AREAS FOR DAMAGE. SEE FIGURES 106 AND 107. LOOK AT THE FAN BLADES AND THE REAR OF THE TURBINE WITH A STRONG LIGHT. IS THERE ANY DAMAGE?
YES
2
IF THE DAMAGE IS ABOVE THE LIMITS IN INSPECTION/ CHECK, REPAIR THE DAMAGE OR REMOVE THE ENGINE, AS NECESSARY.
NO
3
MAKE SURE THE THRUST REVERSER OPERATES CORRECTLY (SEE THE AIRFRAME MANUFACTURER'S MAINTENANCE MANUAL. DOES THE THRUST REVERSER OPERATE CORRECTLY?
NO
4
REPAIR THE THRUST REVERSER AS NECESSARY.
YES
5
DO THE OFF-IDLE SURGE TROUBLESHOOTING PROCEDURE IN THIS SECTION.

L-H0325 (0102)

Reverse Surge Troubleshooting
Figure 105
(Task 72-00-00-810-006)


TYPICAL FOREIGN OBJECT TYPE DAMAGE TO LEADING EDGE OF FAN BLADES
INLET BULLET
TYPICAL DAMAGE TO TRAILING EDGE OF INLET VANES
REMAINS OF FOREIGN OBJECTS AND DAMAGED ENGINE PARTS MAY BE FOUND IN INLET STRUCTURE
L-H0632

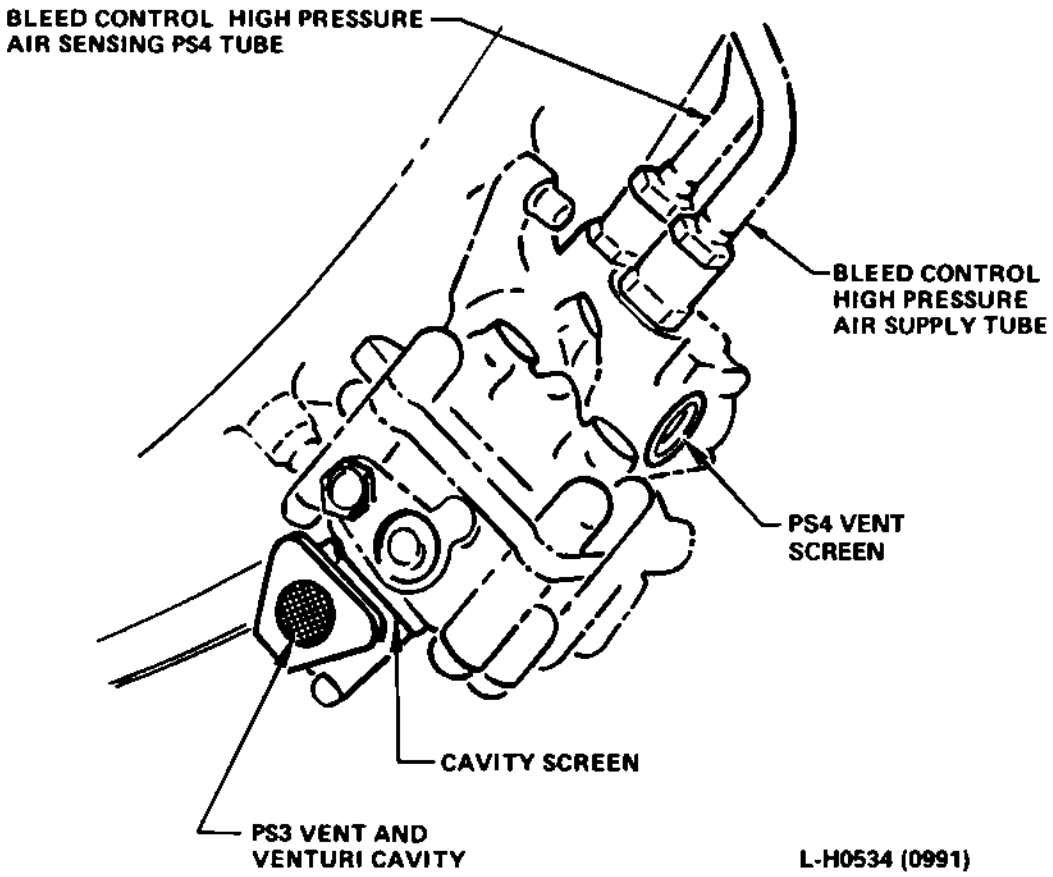
Inlet Area Inspection
Figure 106
(Task 72-00-00-810-006)



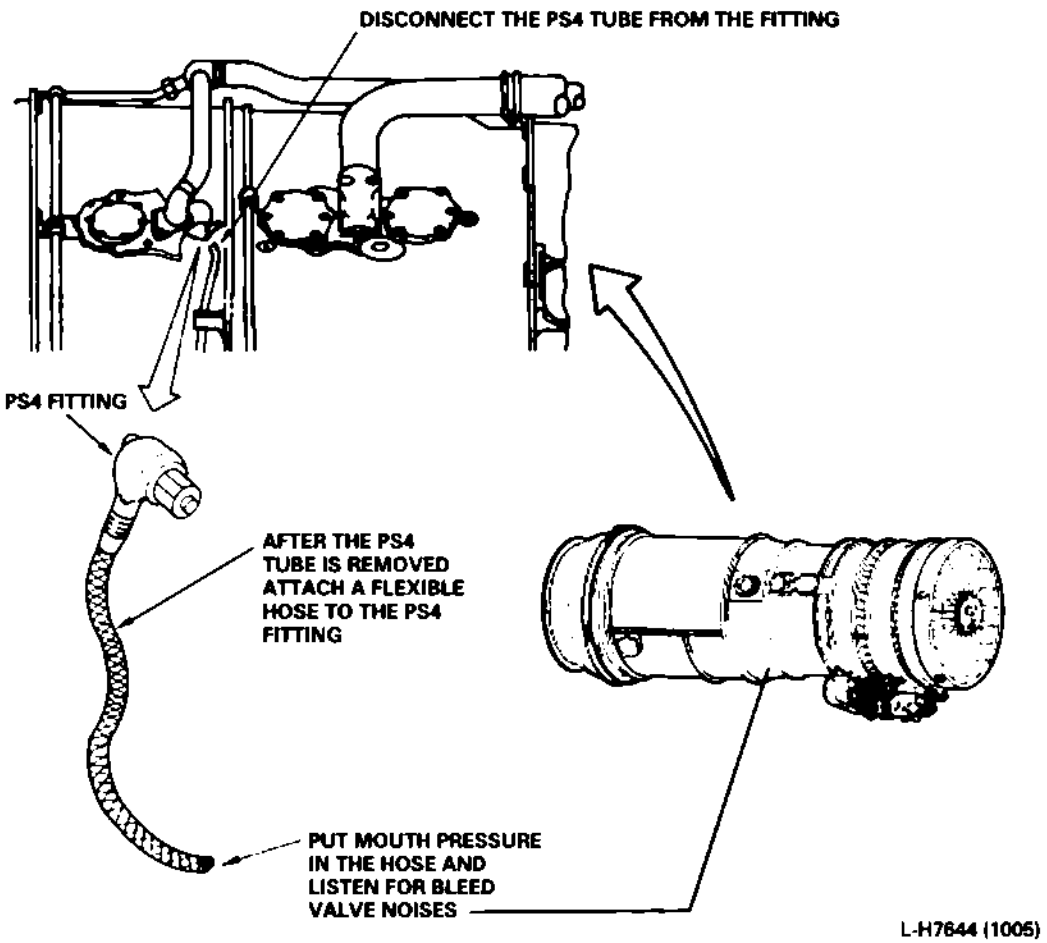
TYPICAL EVIDENCE OF GAS PATH DAMAGE—BROKEN, BENT,TORN,BURNED AND MOLTEN PIECES OF METAL FROM ENGINE PARTS

L—H0533

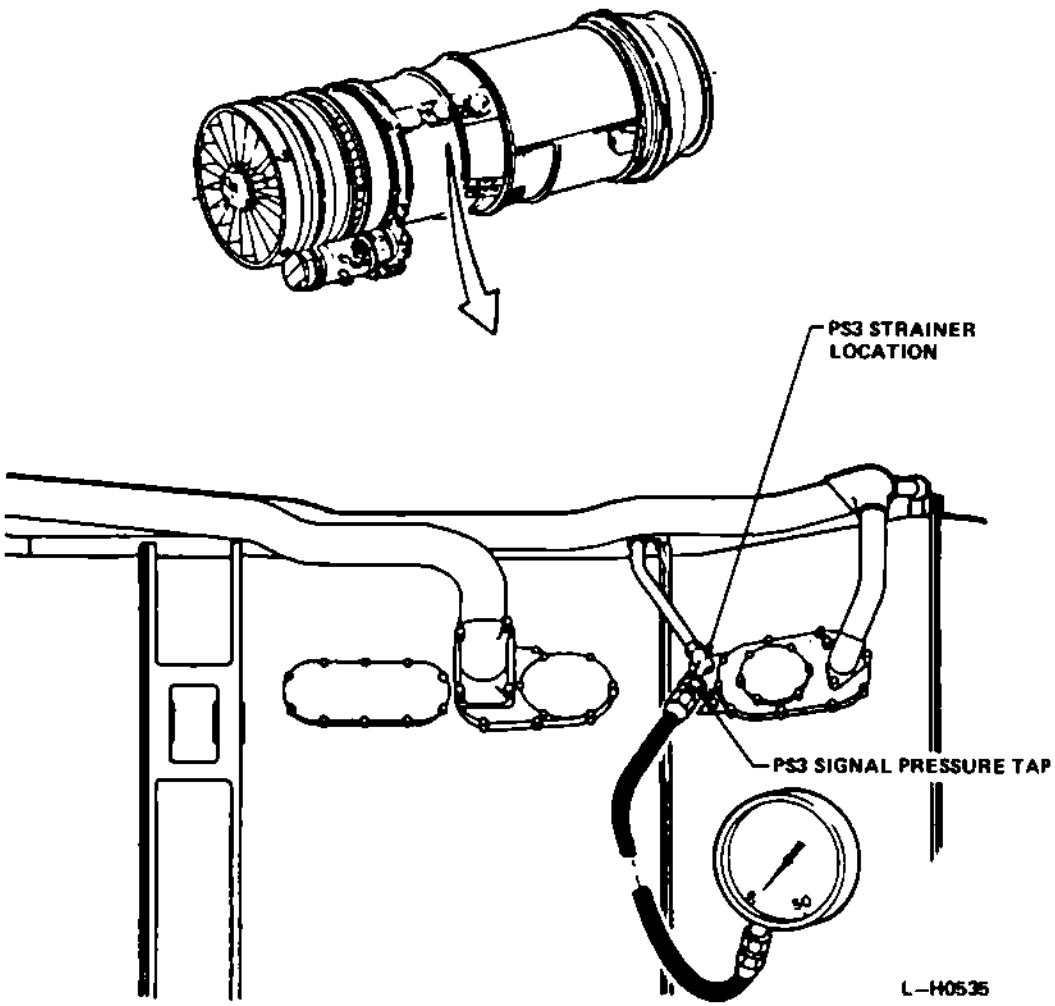
Exhaust Area Inspection
Figure 107
(Task 72-00-00-810-006)


BLEED CONTROL HIGH PRESSURE AIR SENSING PS4 TUBE
BLEED CONTROL HIGH PRESSURE AIR SUPPLY TUBE
PS4 VENT SCREEN
CAVITY SCREEN
PS3 VENT AND VENTURI CAVITY
L-H0534 (0991)

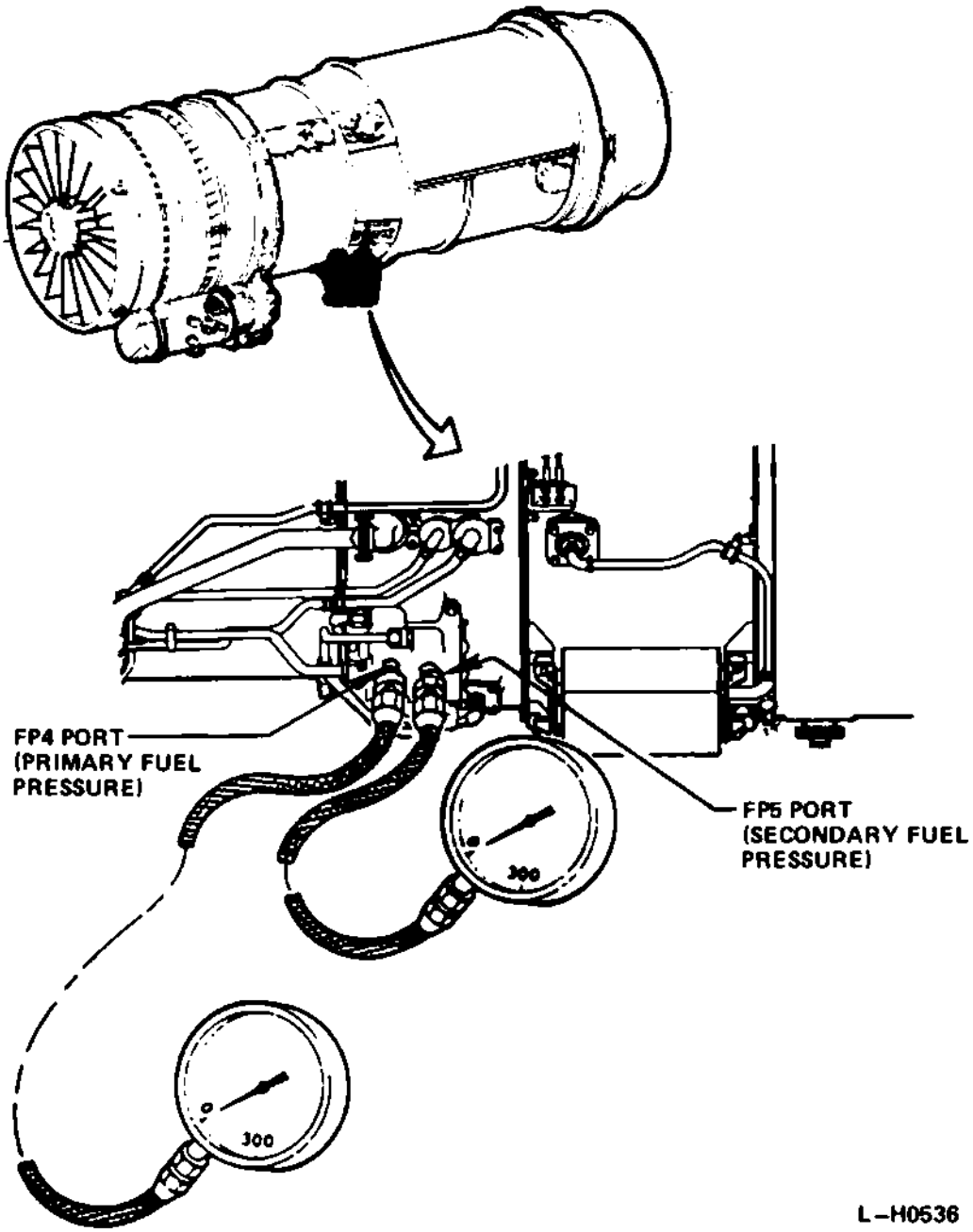
Pressure Ratio Bleed
Control Screens
Figure 108
(Task 72-00-00-810-006)


DISCONNECT THE PS4 TUBE FROM THE FITTING
PS4 FITTING
AFTER THE PS4 TUBE IS REMOVED ATTACH A FLEXIBLE HOSE TO THE PS4 FITTING
PUT MOUTH PRESSURE IN THE HOSE AND LISTEN FOR BLEED VALVE NOISES
L-H7644 (1005)

Bleed Valve Movement
Test Equipment
Figure 108A
(Task 72-00-00-810-006)

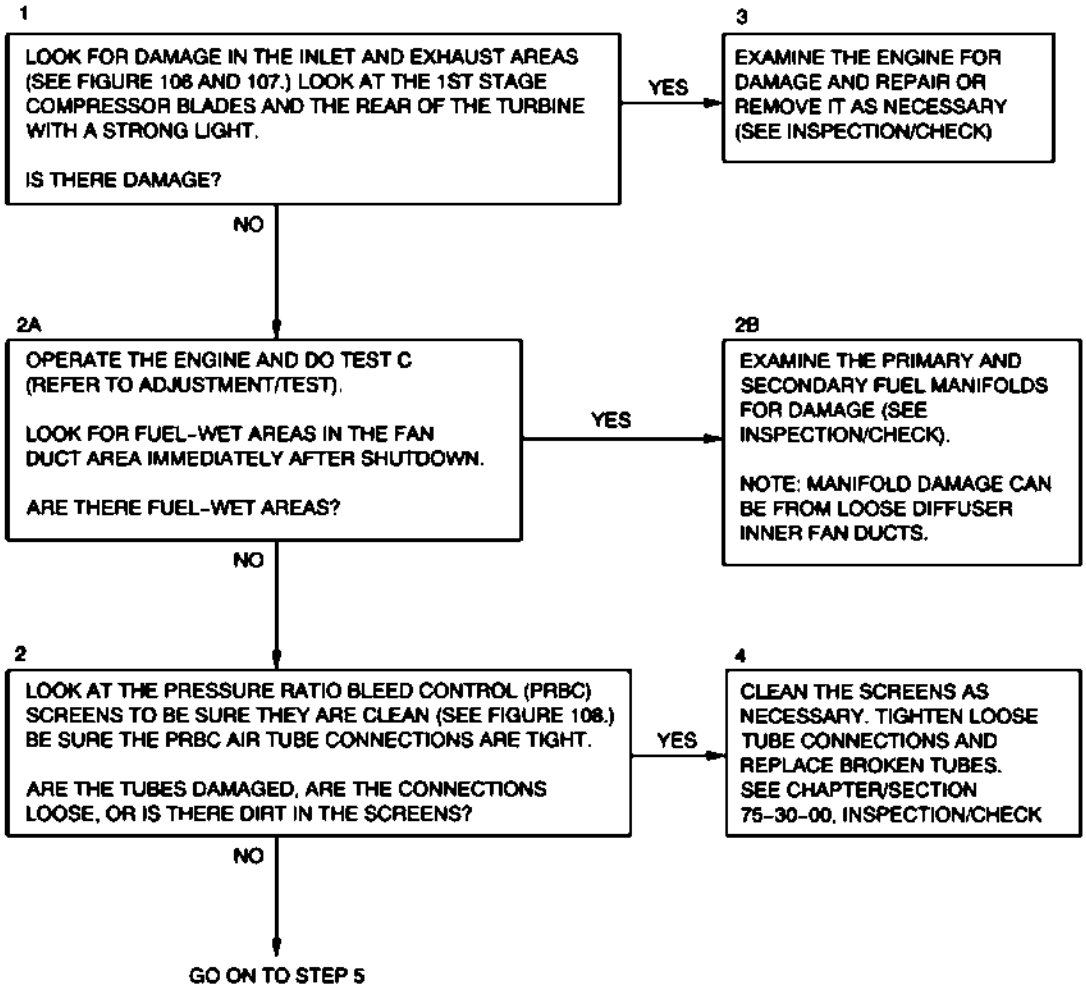


PS3.0 Pressure Measurement
Figure 109
(Task 72-00-00-810-006)



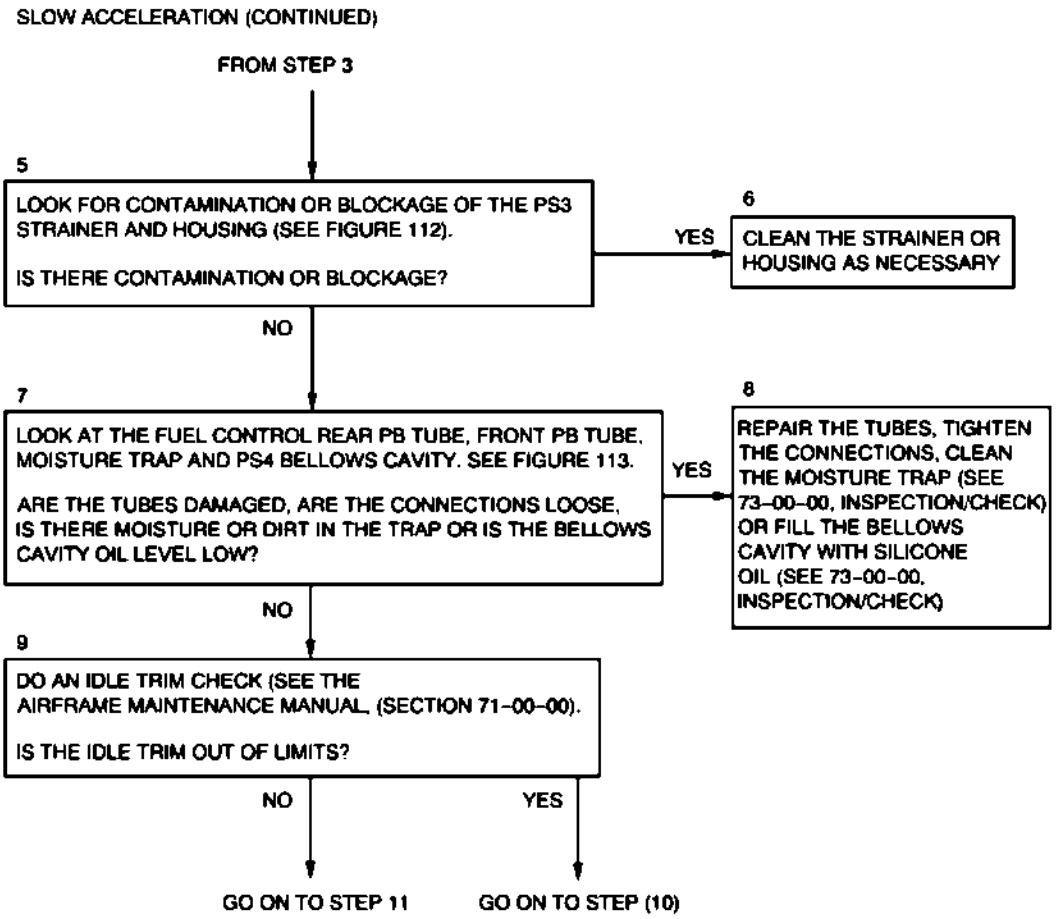
Fuel Pressurizing
And Dump Valve Check
Figure 110
(Task 72-00-00-810-006)

SLOW ACCELERATION


1
LOOK FOR DAMAGE IN THE INLET AND EXHAUST AREAS (SEE FIGURE 106 AND 107.) LOOK AT THE 1ST STAGE COMPRESSOR BLADES AND THE REAR OF THE TURBINE WITH A STRONG LIGHT.
IS THERE DAMAGE?
YES
3
EXAMINE THE ENGINE FOR DAMAGE AND REPAIR OR REMOVE IT AS NECESSARY (SEE INSPECTION/CHECK)
NO
2A
OPERATE THE ENGINE AND DO TEST C (REFER TO ADJUSTMENT/TEST).
LOOK FOR FUEL-WET AREAS IN THE FAN DUCT AREA IMMEDIATELY AFTER SHUTDOWN.
ARE THERE FUEL-WET AREAS?
YES
2B
EXAMINE THE PRIMARY AND SECONDARY FUEL MANIFOLDS FOR DAMAGE (SEE INSPECTION/CHECK).
NOTE: MANIFOLD DAMAGE CAN BE FROM LOOSE DIFFUSER INNER FAN DUCTS.
NO
2
LOOK AT THE PRESSURE RATIO BLEED CONTROL (PRBC) SCREENS TO BE SURE THEY ARE CLEAN (SEE FIGURE 108.) BE SURE THE PRBC AIR TUBE CONNECTIONS ARE TIGHT.
ARE THE TUBES DAMAGED, ARE THE CONNECTIONS LOOSE, OR IS THERE DIRT IN THE SCREENS?
YES
4
CLEAN THE SCREENS AS NECESSARY. TIGHTEN LOOSE TUBE CONNECTIONS AND REPLACE BROKEN TUBES. SEE CHAPTER/SECTION 75-30-00, INSPECTION/CHECK
NO
GO ON TO STEP 5

L-H1286 (1004)
PW V

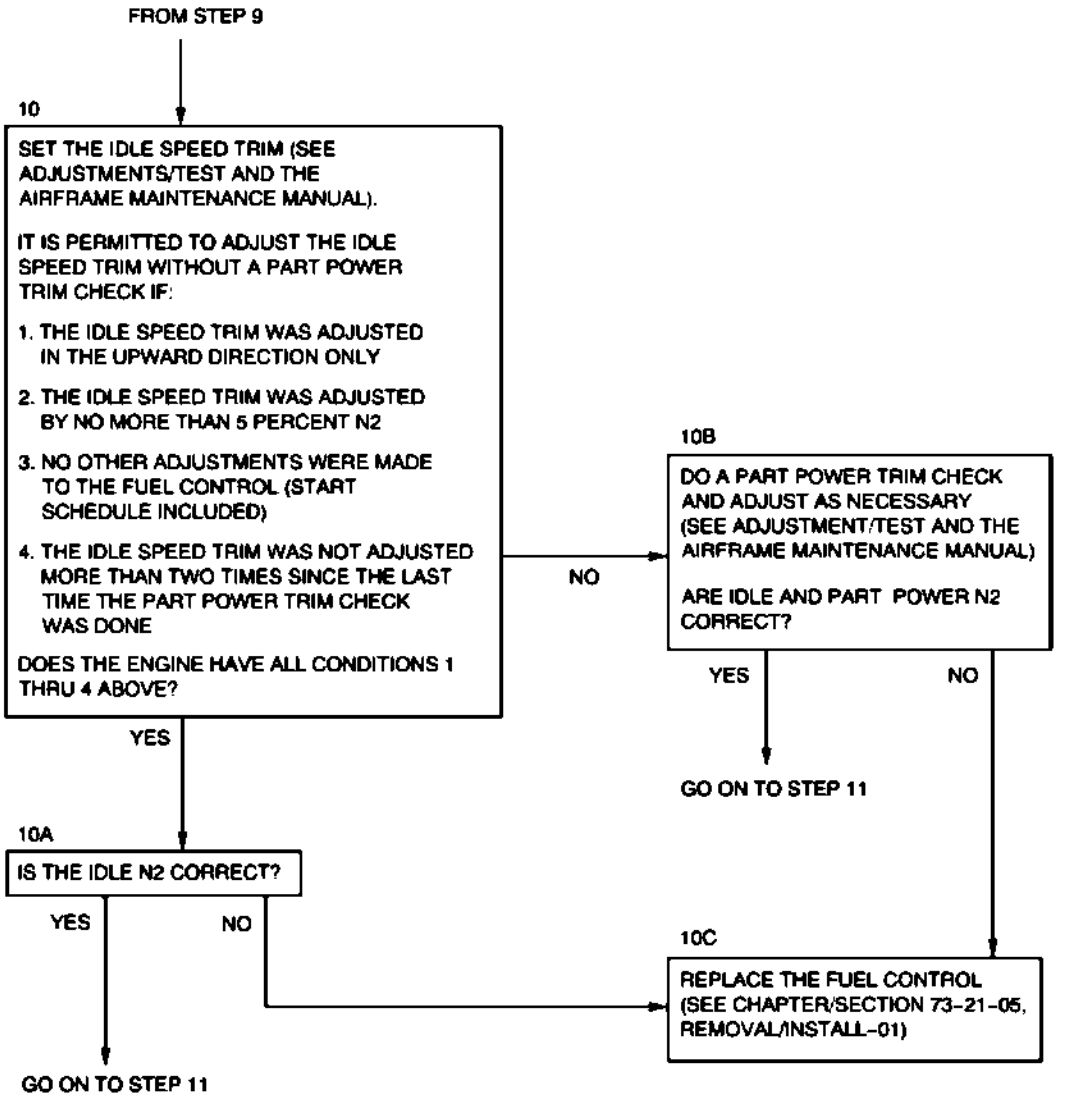
Slow Acceleration Troubleshooting
Figure 111 (Sheet 1)
(Task 72-00-00-810-006)


SLOW ACCELERATION (CONTINUED)
FROM STEP 3
5
LOOK FOR CONTAMINATION OR BLOCKAGE OF THE PS3 STRAINER AND HOUSING (SEE FIGURE 112).
IS THERE CONTAMINATION OR BLOCKAGE?
YES
6
CLEAN THE STRAINER OR HOUSING AS NECESSARY
NO
7
LOOK AT THE FUEL CONTROL REAR PB TUBE, FRONT PB TUBE, MOISTURE TRAP AND PS4 BELLOWS CAVITY. SEE FIGURE 113.
ARE THE TUBES DAMAGED, ARE THE CONNECTIONS LOOSE, IS THERE MOISTURE OR DIRT IN THE TRAP OR IS THE BELLOWS CAVITY OIL LEVEL LOW?
YES
8
REPAIR THE TUBES, TIGHTEN THE CONNECTIONS, CLEAN THE MOISTURE TRAP (SEE 73-00-00, INSPECTION/CHECK) OR FILL THE BELLOWS CAVITY WITH SILICONE OIL (SEE 73-00-00, INSPECTION/CHECK)
NO
9
DO AN IDLE TRIM CHECK (SEE THE AIRFRAME MAINTENANCE MANUAL, (SECTION 71-00-00).
IS THE IDLE TRIM OUT OF LIMITS?
NO
YES
GO ON TO STEP 11
GO ON TO STEP (10)

L-H1287 (0102)
PW V

Slow Acceleration Troubleshooting
Figure 111 (Sheet 2)
(Task 72-00-00-810-006)

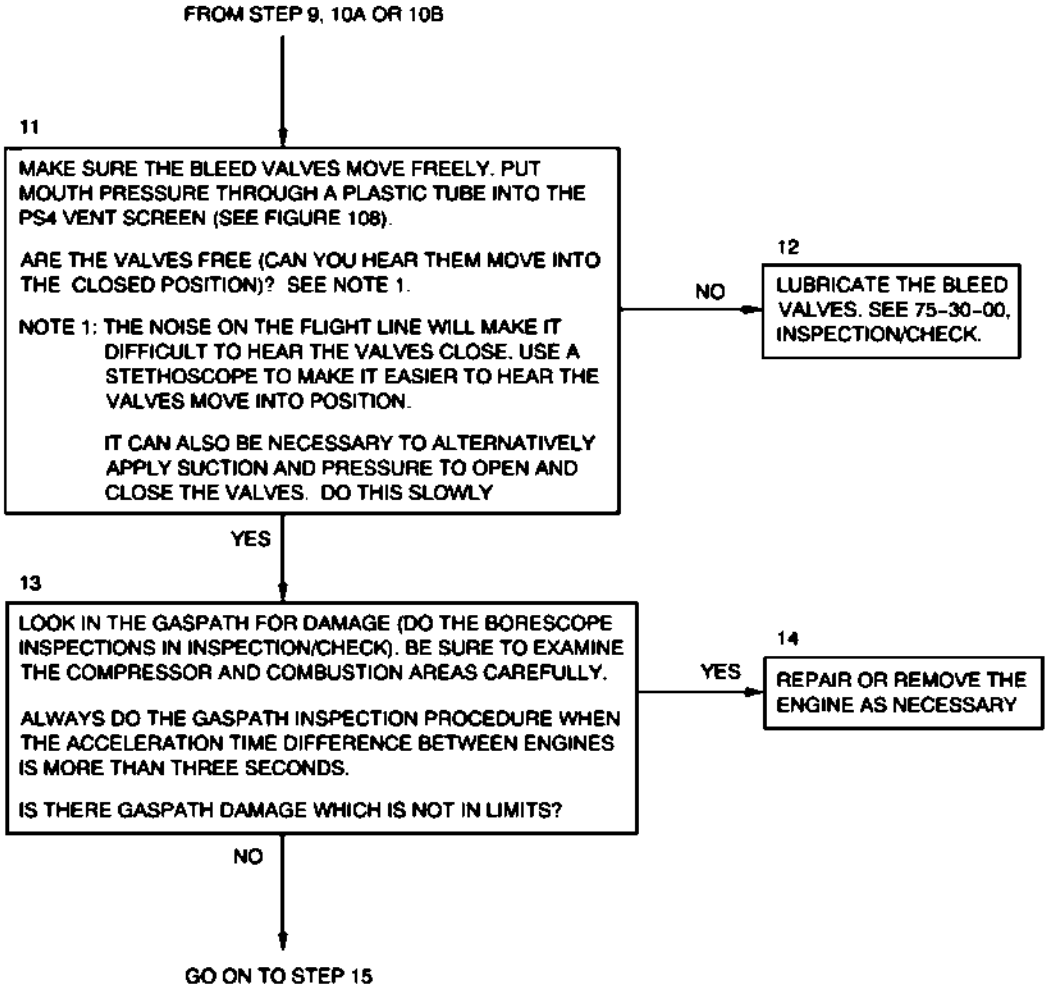
SLOW ACCELERATION (CONTINUED)


FROM STEP 9
10
SET THE IDLE SPEED TRIM (SEE ADJUSTMENTS/TEST AND THE AIRFRAME MAINTENANCE MANUAL).
IT IS PERMITTED TO ADJUST THE IDLE SPEED TRIM WITHOUT A PART POWER TRIM CHECK IF:
1. THE IDLE SPEED TRIM WAS ADJUSTED IN THE UPWARD DIRECTION ONLY
2. THE IDLE SPEED TRIM WAS ADJUSTED BY NO MORE THAN 5 PERCENT N2
3. NO OTHER ADJUSTMENTS WERE MADE TO THE FUEL CONTROL (START SCHEDULE INCLUDED)
4. THE IDLE SPEED TRIM WAS NOT ADJUSTED MORE THAN TWO TIMES SINCE THE LAST TIME THE PART POWER TRIM CHECK WAS DONE
DOES THE ENGINE HAVE ALL CONDITIONS 1 THRU 4 ABOVE?
NO
10B
DO A PART POWER TRIM CHECK AND ADJUST AS NECESSARY (SEE ADJUSTMENT/TEST AND THE AIRFRAME MAINTENANCE MANUAL)
ARE IDLE AND PART POWER N2 CORRECT?
YES
NO
GO ON TO STEP 11
YES
10A
IS THE IDLE N2 CORRECT?
YES
NO
GO ON TO STEP 11
10C
REPLACE THE FUEL CONTROL (SEE CHAPTER/SECTION 73-21-05, REMOVAL/INSTALL-01)

L-H4325 (0800)
PW V

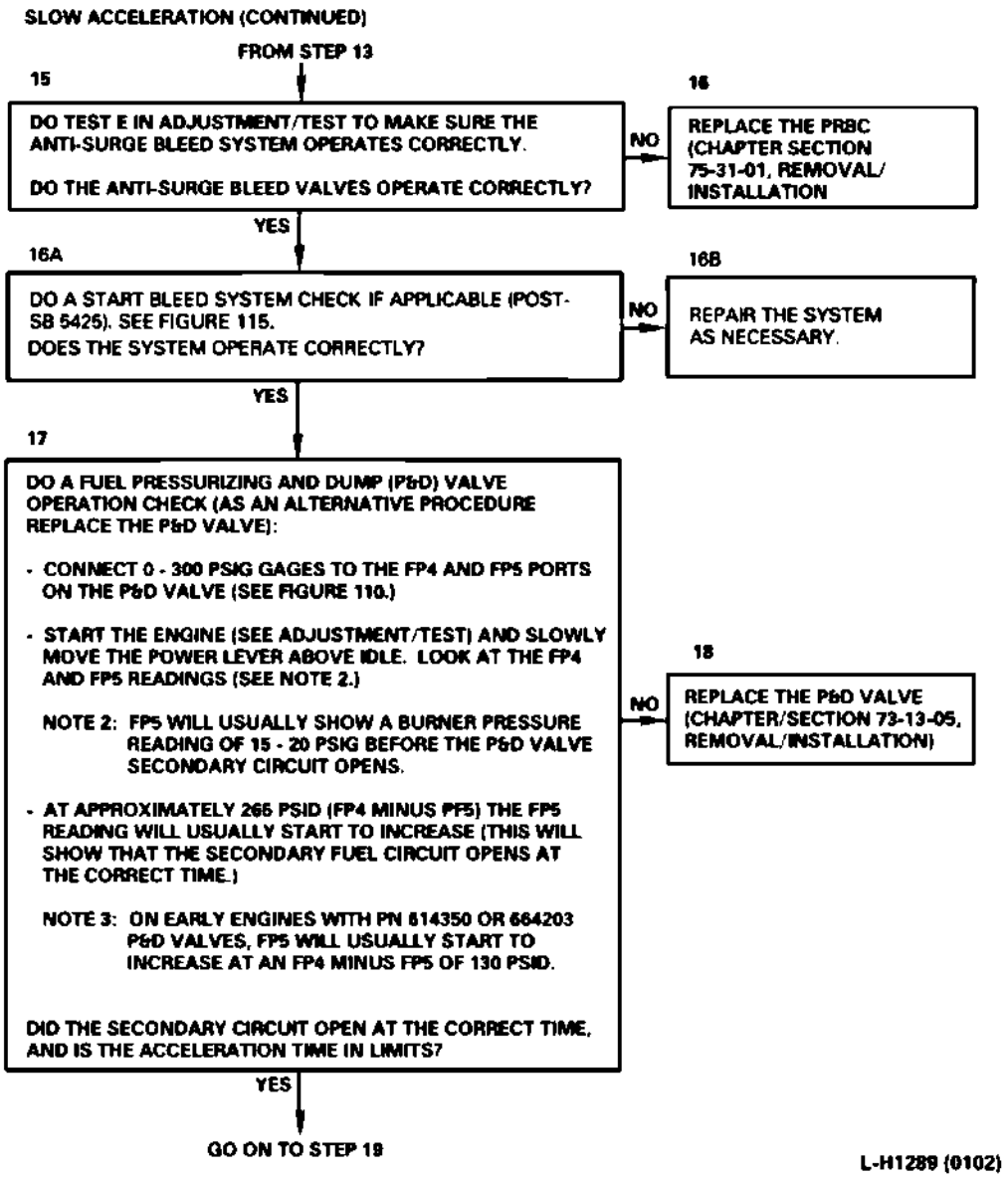
Slow Acceleration Troubleshooting
Figure 111 (Sheet 3)
(Task 72-00-00-810-006)

SLOW ACCELERATION (CONTINUED)

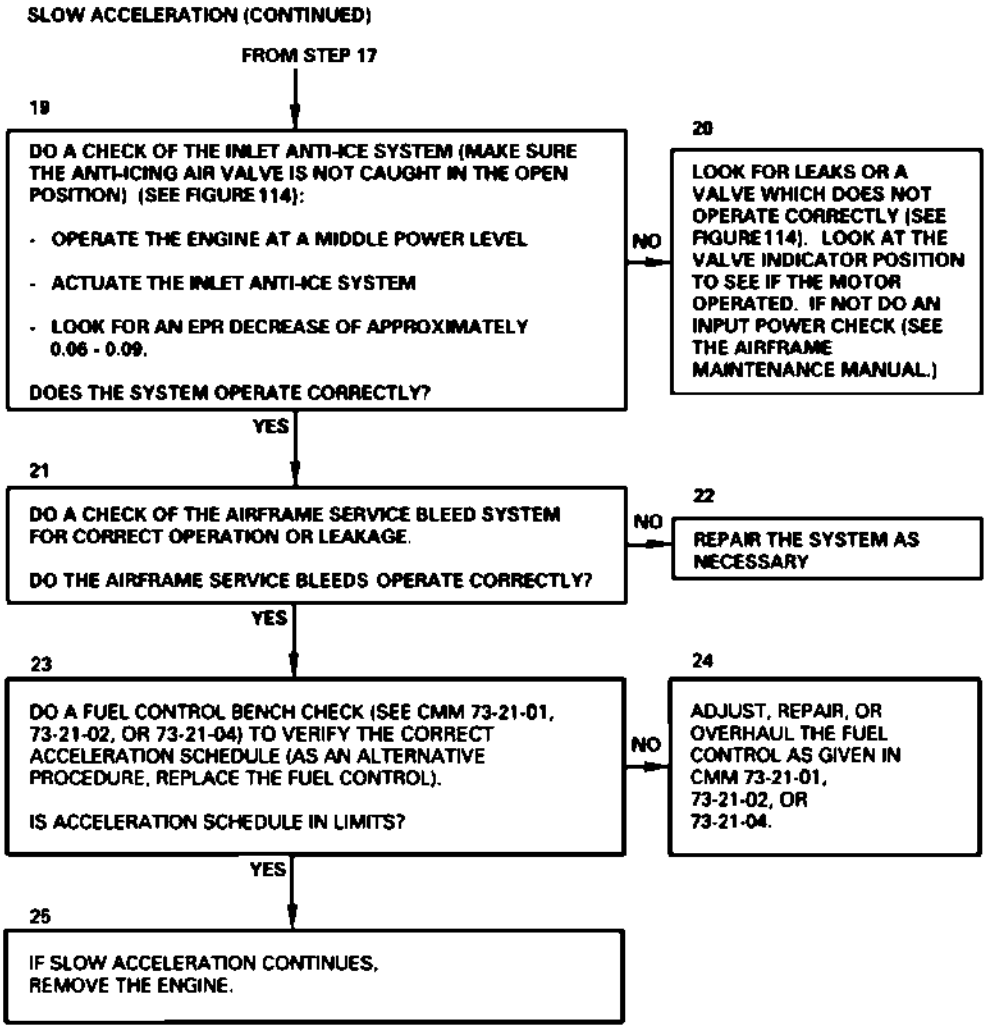

FROM STEP 9, 10A OR 10B
11
MAKE SURE THE BLEED VALVES MOVE FREELY. PUT MOUTH PRESSURE THROUGH A PLASTIC TUBE INTO THE PS4 VENT SCREEN (SEE FIGURE 108).
ARE THE VALVES FREE (CAN YOU HEAR THEM MOVE INTO THE CLOSED POSITION)? SEE NOTE 1.
NOTE 1: THE NOISE ON THE FLIGHT LINE WILL MAKE IT DIFFICULT TO HEAR THE VALVES CLOSE. USE A STETHOSCOPE TO MAKE IT EASIER TO HEAR THE VALVES MOVE INTO POSITION.
IT CAN ALSO BE NECESSARY TO ALTERNATIVELY APPLY SUCTION AND PRESSURE TO OPEN AND CLOSE THE VALVES. DO THIS SLOWLY
NO
12
LUBRICATE THE BLEED VALVES. SEE 75-30-00, INSPECTION/CHECK.
YES
13
LOOK IN THE GASPATH FOR DAMAGE (DO THE BORESCOPE INSPECTIONS IN INSPECTION/CHECK). BE SURE TO EXAMINE THE COMPRESSOR AND COMBUSTION AREAS CAREFULLY.
ALWAYS DO THE GASPATH INSPECTION PROCEDURE WHEN THE ACCELERATION TIME DIFFERENCE BETWEEN ENGINES IS MORE THAN THREE SECONDS.
IS THERE GASPATH DAMAGE WHICH IS NOT IN LIMITS?
YES
14
REPAIR OR REMOVE THE ENGINE AS NECESSARY
NO
GO ON TO STEP 15

L-H1288 (0102)
PW V

Slow Acceleration Troubleshooting
Figure 111 (Sheet 4)
(Task 72-00-00-810-006)

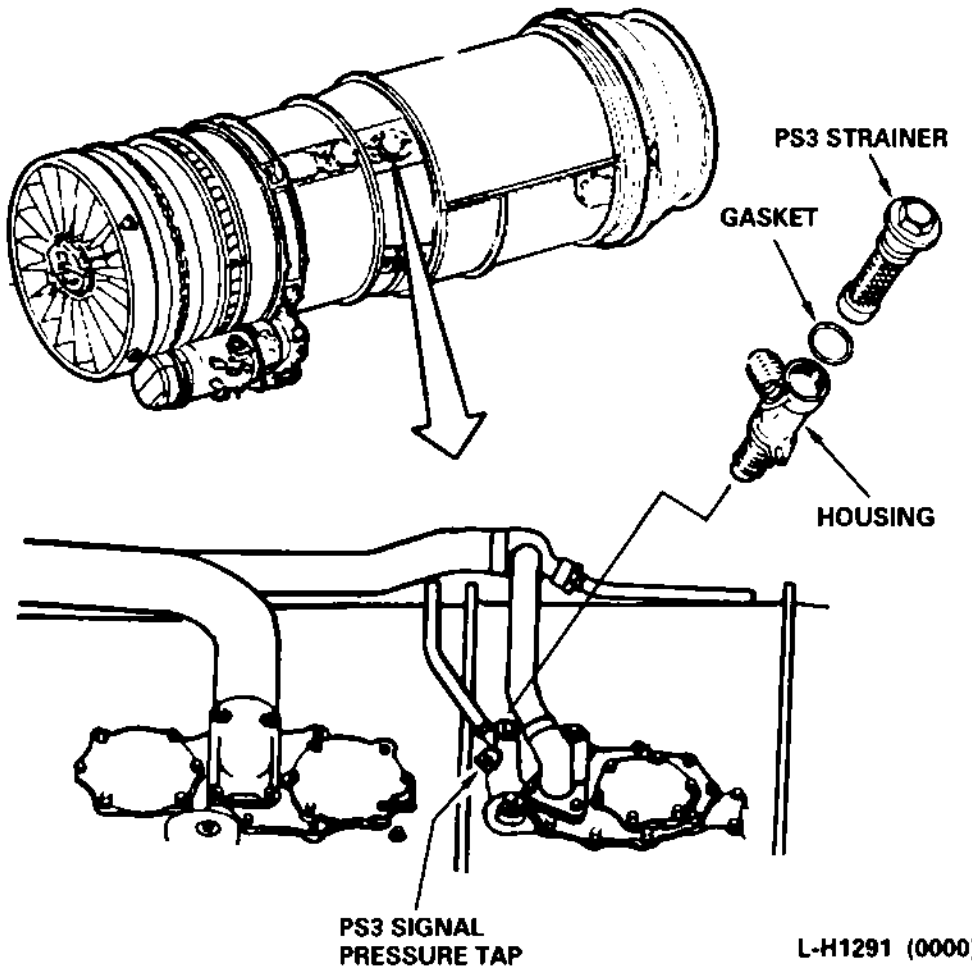

SLOW ACCELERATION (CONTINUED)
FROM STEP 13
15
DO TEST E IN ADJUSTMENT/TEST TO MAKE SURE THE ANTI-SURGE BLEED SYSTEM OPERATES CORRECTLY.
DO THE ANTI-SURGE BLEED VALVES OPERATE CORRECTLY?
NO
16
REPLACE THE PRBC (CHAPTER SECTION 75-31-01, REMOVAL/ INSTALLATION
YES
16A
DO A START BLEED SYSTEM CHECK IF APPLICABLE (POST-SB 5425). SEE FIGURE 115.
DOES THE SYSTEM OPERATE CORRECTLY?
NO
16B
REPAIR THE SYSTEM AS NECESSARY.
YES
17
DO A FUEL PRESSURIZING AND DUMP (P&D) VALVE OPERATION CHECK (AS AN ALTERNATIVE PROCEDURE REPLACE THE P&D VALVE):
- CONNECT 0 - 300 PSIG GAGES TO THE FP4 AND FP5 PORTS ON THE P&D VALVE (SEE FIGURE 110.)
- START THE ENGINE (SEE ADJUSTMENT/TEST) AND SLOWLY MOVE THE POWER LEVER ABOVE IDLE. LOOK AT THE FP4 AND FP5 READINGS (SEE NOTE 2.)
NOTE 2: FP5 WILL USUALLY SHOW A BURNER PRESSURE READING OF 15 - 20 PSIG BEFORE THE P&D VALVE SECONDARY CIRCUIT OPENS.
- AT APPROXIMATELY 266 PSID (FP4 MINUS PF5) THE FP5 READING WILL USUALLY START TO INCREASE (THIS WILL SHOW THAT THE SECONDARY FUEL CIRCUIT OPENS AT THE CORRECT TIME.)
NOTE 3: ON EARLY ENGINES WITH PN 614350 OR 664203 P&D VALVES, FP5 WILL USUALLY START TO INCREASE AT AN FP4 MINUS FP5 OF 130 PSID.
DID THE SECONDARY CIRCUIT OPEN AT THE CORRECT TIME, AND IS THE ACCELERATION TIME IN LIMITS?
NO
18
REPLACE THE P&D VALVE (CHAPTER/SECTION 73-13-05, REMOVAL/INSTALLATION)
YES
GO ON TO STEP 19
L-H1289 (0102)

Slow Acceleration Troubleshooting
Figure 111 (Sheet 5)
(Task 72-00-00-810-006)

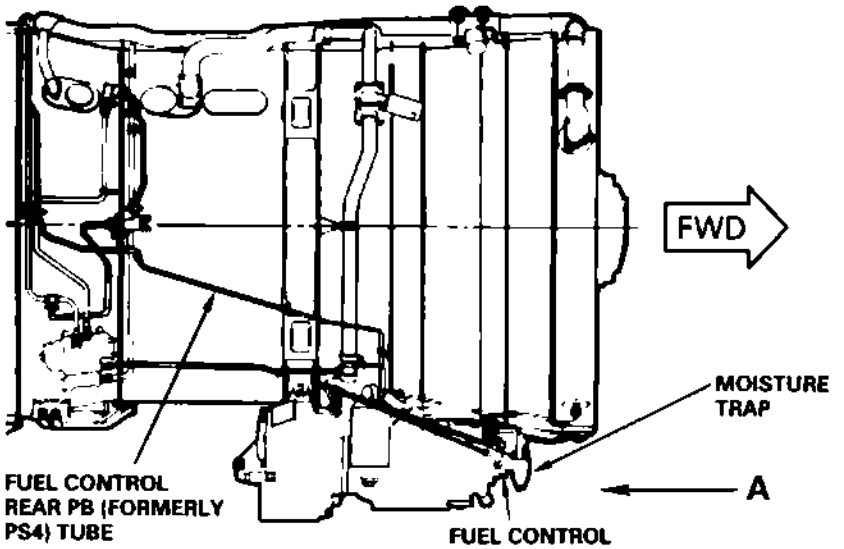

SLOW ACCELERATION (CONTINUED)
FROM STEP 17
19
DO A CHECK OF THE INLET ANTI-ICE SYSTEM (MAKE SURE THE ANTI-ICING AIR VALVE IS NOT CAUGHT IN THE OPEN POSITION) (SEE FIGURE 114):
- OPERATE THE ENGINE AT A MIDDLE POWER LEVEL
- ACTUATE THE INLET ANTI-ICE SYSTEM
- LOOK FOR AN EPR DECREASE OF APPROXIMATELY 0.06 - 0.09.
DOES THE SYSTEM OPERATE CORRECTLY?
NO
20
LOOK FOR LEAKS OR A VALVE WHICH DOES NOT OPERATE CORRECTLY (SEE FIGURE 114). LOOK AT THE VALVE INDICATOR POSITION TO SEE IF THE MOTOR OPERATED. IF NOT DO AN INPUT POWER CHECK (SEE THE AIRFRAME MAINTENANCE MANUAL.)
YES
21
DO A CHECK OF THE AIRFRAME SERVICE BLEED SYSTEM FOR CORRECT OPERATION OR LEAKAGE.
DO THE AIRFRAME SERVICE BLEEDS OPERATE CORRECTLY?
NO
22
REPAIR THE SYSTEM AS NECESSARY
YES
23
DO A FUEL CONTROL BENCH CHECK (SEE CMM 73-21-01, 73-21-02, OR 73-21-04) TO VERIFY THE CORRECT ACCELERATION SCHEDULE (AS AN ALTERNATIVE PROCEDURE, REPLACE THE FUEL CONTROL).
IS ACCELERATION SCHEDULE IN LIMITS?
NO
24
ADJUST, REPAIR, OR OVERHAUL THE FUEL CONTROL AS GIVEN IN CMM 73-21-01, 73-21-02, OR 73-21-04.
YES
25
IF SLOW ACCELERATION CONTINUES, REMOVE THE ENGINE.

L-H1290 (0102)

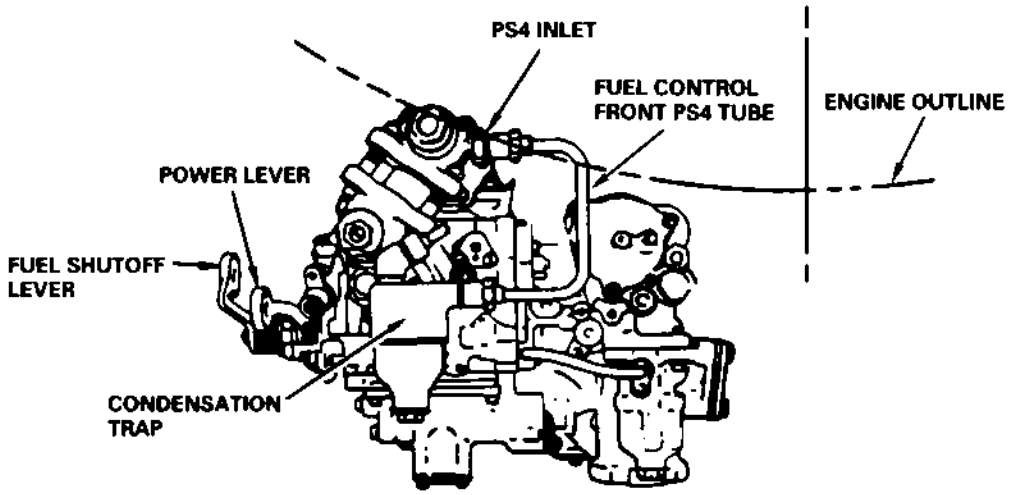
Slow Acceleration Troubleshooting
Figure 111 (Sheet 6)
(Task 72-00-00-810-006)



PS3 Strainer Inspection
Figure 112
(Task 72-00-00-810-006)



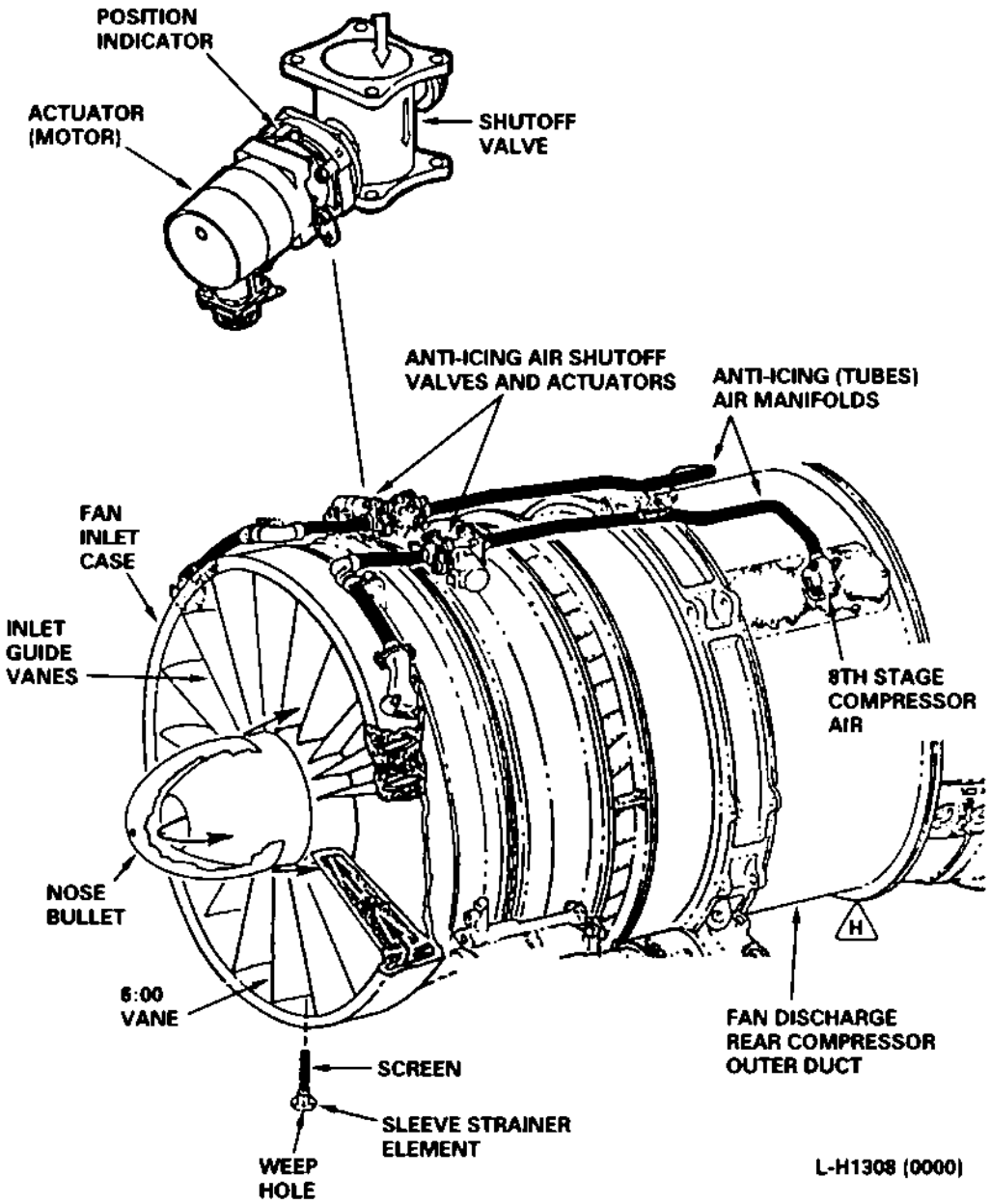
RIGHT SIDE VIEW



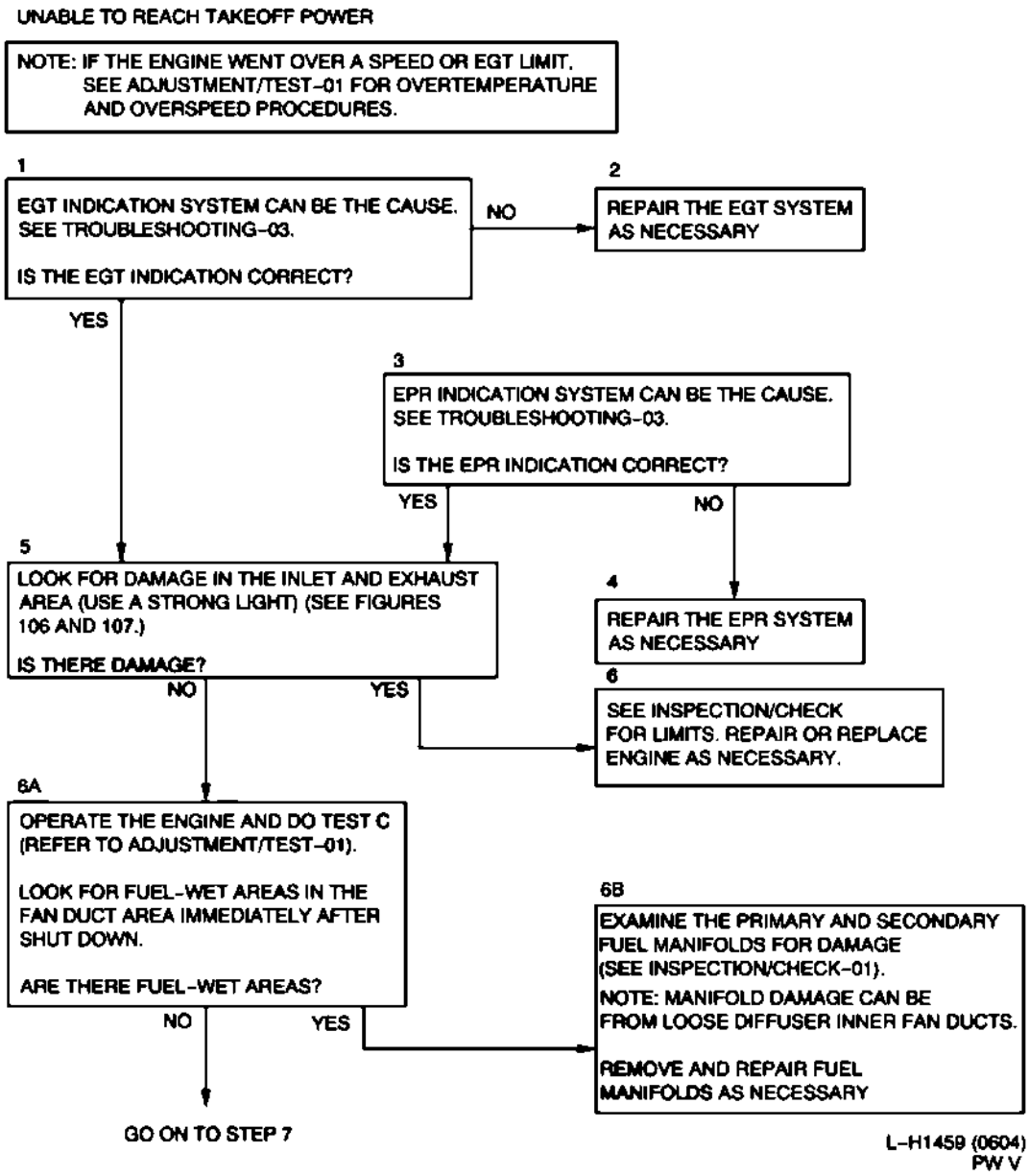
VIEW IN DIRECTION A

L-H1300 (0000)

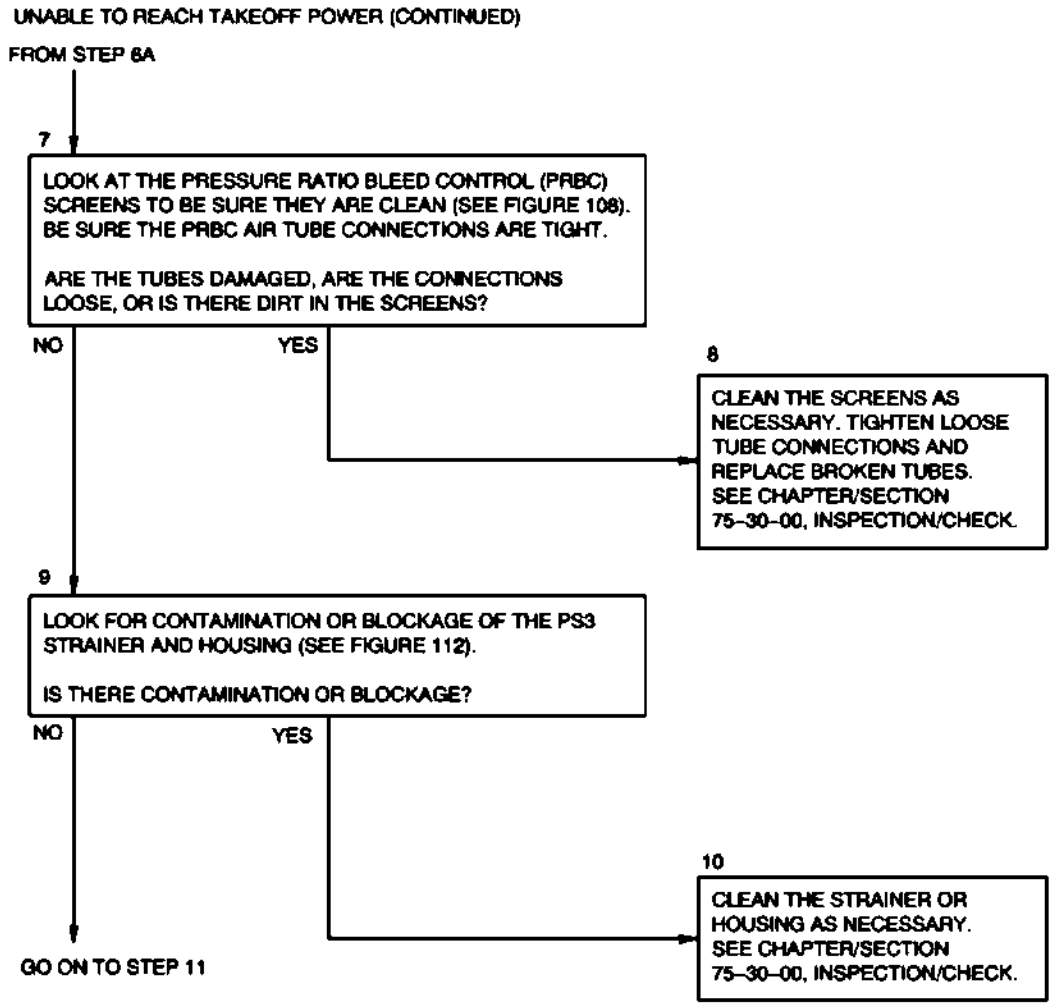
Fuel Control, PB And PS4 Tubes, And Moisture Trap
Figure 113
(Task 72-00-00-810-006)



Inlet Anti-Ice System
Operation Check
Figure 114
(Task 72-00-00-810-006)

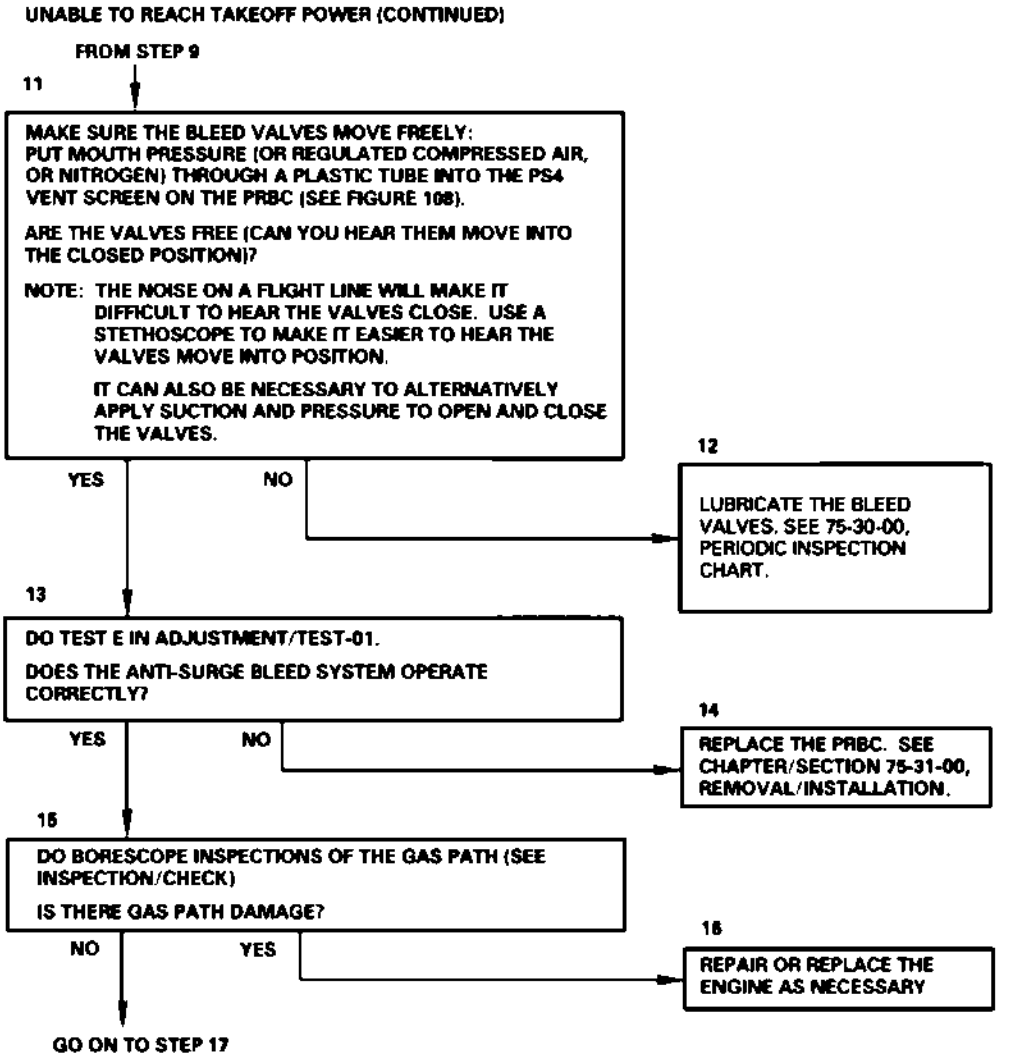

UNABLE TO REACH TAKEOFF POWER
NOTE: IF THE ENGINE WENT OVER A SPEED OR EGT LIMIT, SEE ADJUSTMENT/TEST-01 FOR OVERTEMPERATURE AND OVERSPEED PROCEDURES.
1
EGT INDICATION SYSTEM CAN BE THE CAUSE. SEE TROUBLESHOOTING-03.
IS THE EGT INDICATION CORRECT?
NO
2
REPAIR THE EGT SYSTEM AS NECESSARY
YES
3
EPR INDICATION SYSTEM CAN BE THE CAUSE. SEE TROUBLESHOOTING-03.
IS THE EPR INDICATION CORRECT?
YES
NO
4
REPAIR THE EPR SYSTEM AS NECESSARY
5
LOOK FOR DAMAGE IN THE INLET AND EXHAUST AREA (USE A STRONG LIGHT) (SEE FIGURES 106 AND 107.)
IS THERE DAMAGE?
NO
YES
6
SEE INSPECTION/CHECK FOR LIMITS. REPAIR OR REPLACE ENGINE AS NECESSARY.
6A
OPERATE THE ENGINE AND DO TEST C (REFER TO ADJUSTMENT/TEST-01).
LOOK FOR FUEL-WET AREAS IN THE FAN DUCT AREA IMMEDIATELY AFTER SHUT DOWN.
ARE THERE FUEL-WET AREAS?
NO
YES
6B
EXAMINE THE PRIMARY AND SECONDARY FUEL MANIFOLDS FOR DAMAGE (SEE INSPECTION/CHECK-01).
NOTE: MANIFOLD DAMAGE CAN BE FROM LOOSE DIFFUSER INNER FAN DUCTS.
REMOVE AND REPAIR FUEL MANIFOLDS AS NECESSARY
GO ON TO STEP 7
L-H1459 (0604)
PW V

Unable To Reach Takeoff
Power Troubleshooting
Figure 115 (Sheet 1)
(Task 72-00-00-810-006)

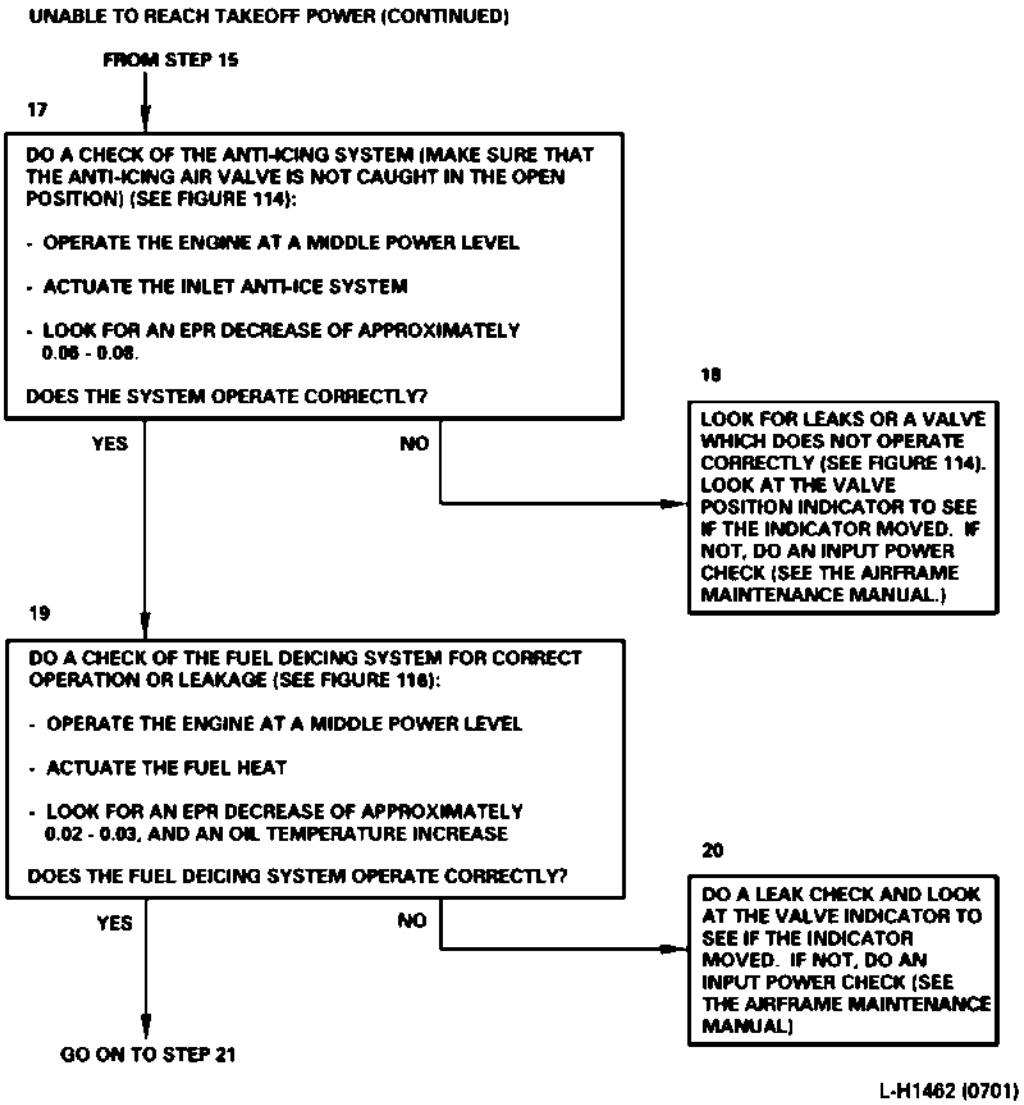

UNABLE TO REACH TAKEOFF POWER (CONTINUED)
FROM STEP 6A
7
LOOK AT THE PRESSURE RATIO BLEED CONTROL (PRBC) SCREENS TO BE SURE THEY ARE CLEAN (SEE FIGURE 108). BE SURE THE PRBC AIR TUBE CONNECTIONS ARE TIGHT.
ARE THE TUBES DAMAGED, ARE THE CONNECTIONS LOOSE, OR IS THERE DIRT IN THE SCREENS?
NO
YES
8
CLEAN THE SCREENS AS NECESSARY. TIGHTEN LOOSE TUBE CONNECTIONS AND REPLACE BROKEN TUBES. SEE CHAPTER/SECTION 75-30-00, INSPECTION/CHECK.
9
LOOK FOR CONTAMINATION OR BLOCKAGE OF THE PS3 STRAINER AND HOUSING (SEE FIGURE 112).
IS THERE CONTAMINATION OR BLOCKAGE?
NO
YES
10
CLEAN THE STRAINER OR HOUSING AS NECESSARY. SEE CHAPTER/SECTION 75-30-00, INSPECTION/CHECK.
GO ON TO STEP 11

L-H1480 (1004)
PW V

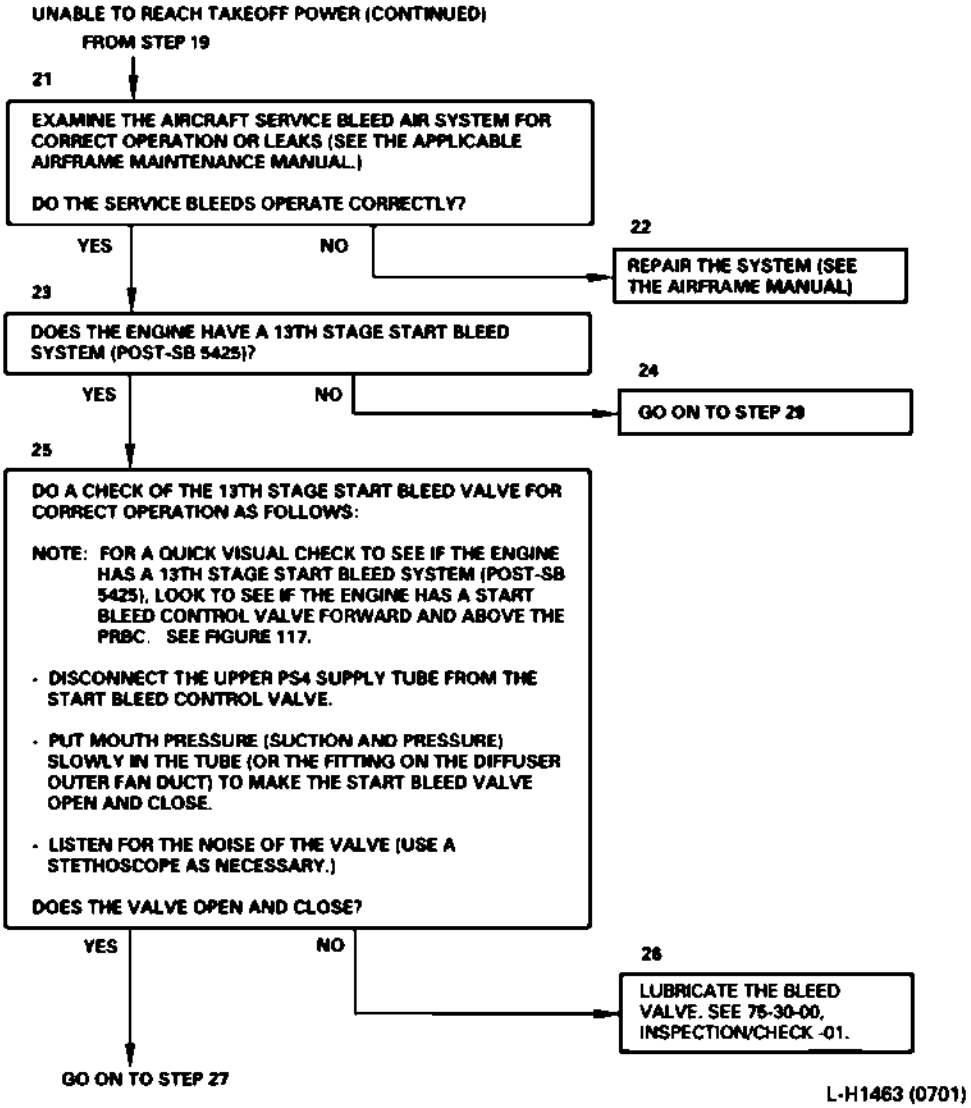
Unable To Reach Takeoff
Power Troubleshooting
Figure 115 (Sheet 2)
(Task 72-00-00-810-006)


UNABLE TO REACH TAKEOFF POWER (CONTINUED)
FROM STEP 9
11
MAKE SURE THE BLEED VALVES MOVE FREELY: PUT MOUTH PRESSURE (OR REGULATED COMPRESSED AIR, OR NITROGEN) THROUGH A PLASTIC TUBE INTO THE PS4 VENT SCREEN ON THE PRBC (SEE FIGURE 108).
ARE THE VALVES FREE (CAN YOU HEAR THEM MOVE INTO THE CLOSED POSITION)?
NOTE: THE NOISE ON A FLIGHT LINE WILL MAKE IT DIFFICULT TO HEAR THE VALVES CLOSE. USE A STETHOSCOPE TO MAKE IT EASIER TO HEAR THE VALVES MOVE INTO POSITION.
IT CAN ALSO BE NECESSARY TO ALTERNATIVELY APPLY SUCTION AND PRESSURE TO OPEN AND CLOSE THE VALVES.
YES
NO
12
LUBRICATE THE BLEED VALVES. SEE 75-30-00, PERIODIC INSPECTION CHART.
13
DO TEST E IN ADJUSTMENT/TEST-01.
DOES THE ANTI-SURGE BLEED SYSTEM OPERATE CORRECTLY?
YES
NO
14
REPLACE THE PRBC. SEE CHAPTER/SECTION 75-31-00, REMOVAL/INSTALLATION.
15
DO BORESCOPE INSPECTIONS OF THE GAS PATH (SEE INSPECTION/CHECK)
IS THERE GAS PATH DAMAGE?
NO
YES
16
REPAIR OR REPLACE THE ENGINE AS NECESSARY
GO ON TO STEP 17
L-H1461 (0102)

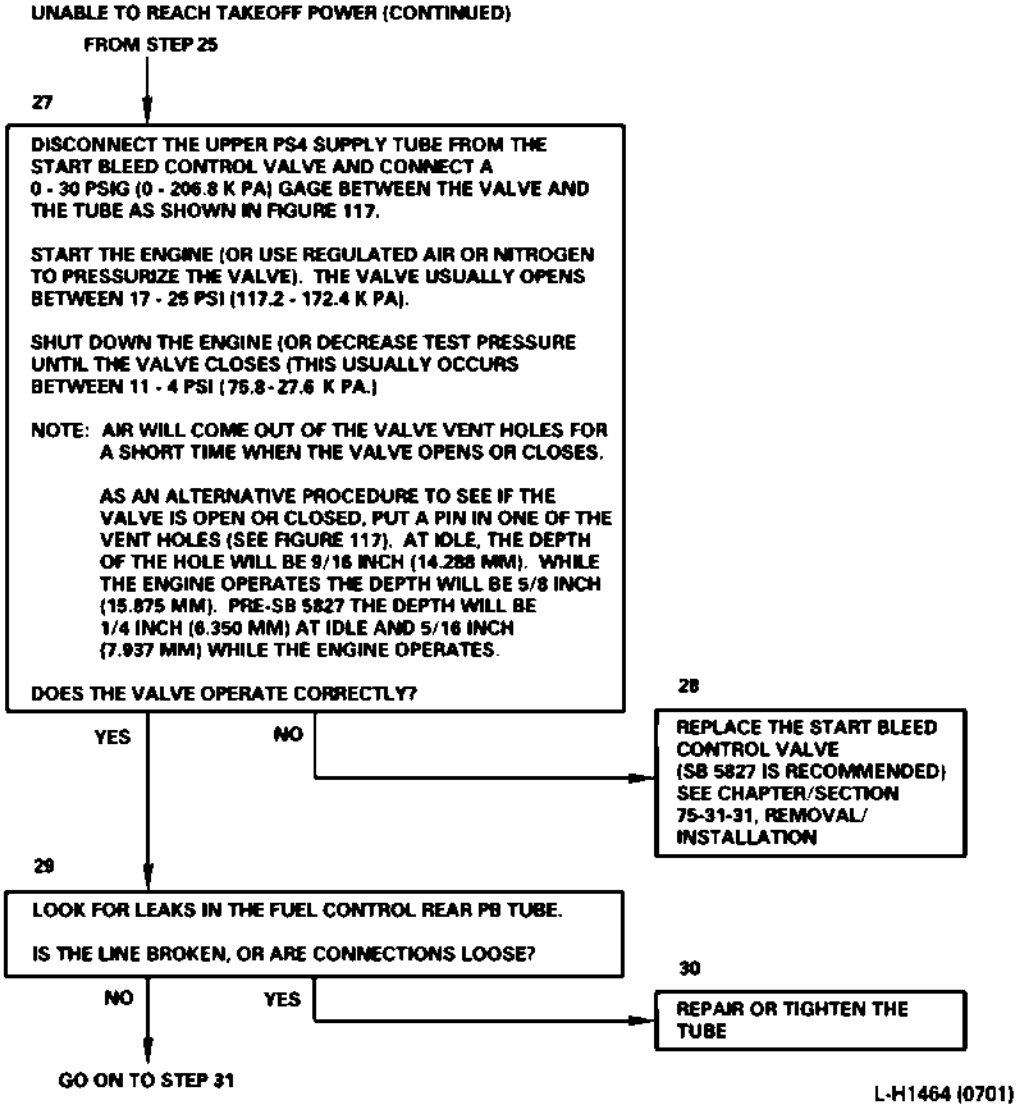
Unable To Reach Takeoff
Power Troubleshooting
Figure 115 (Sheet 3)
(Task 72-00-00-810-006)


UNABLE TO REACH TAKEOFF POWER (CONTINUED)
FROM STEP 15
17
DO A CHECK OF THE ANTI-ICING SYSTEM (MAKE SURE THAT THE ANTI-ICING AIR VALVE IS NOT CAUGHT IN THE OPEN POSITION) (SEE FIGURE 114):
- OPERATE THE ENGINE AT A MIDDLE POWER LEVEL
- ACTUATE THE INLET ANTI-ICE SYSTEM
- LOOK FOR AN EPR DECREASE OF APPROXIMATELY 0.06 - 0.08.
DOES THE SYSTEM OPERATE CORRECTLY?
YES
NO
18
LOOK FOR LEAKS OR A VALVE WHICH DOES NOT OPERATE CORRECTLY (SEE FIGURE 114). LOOK AT THE VALVE POSITION INDICATOR TO SEE IF THE INDICATOR MOVED. IF NOT, DO AN INPUT POWER CHECK (SEE THE AIRFRAME MAINTENANCE MANUAL.)
19
DO A CHECK OF THE FUEL DEICING SYSTEM FOR CORRECT OPERATION OR LEAKAGE (SEE FIGURE 116):
- OPERATE THE ENGINE AT A MIDDLE POWER LEVEL
- ACTUATE THE FUEL HEAT
- LOOK FOR AN EPR DECREASE OF APPROXIMATELY 0.02 - 0.03, AND AN OIL TEMPERATURE INCREASE
DOES THE FUEL DEICING SYSTEM OPERATE CORRECTLY?
YES
NO
20
DO A LEAK CHECK AND LOOK AT THE VALVE INDICATOR TO SEE IF THE INDICATOR MOVED. IF NOT, DO AN INPUT POWER CHECK (SEE THE AIRFRAME MAINTENANCE MANUAL)
GO ON TO STEP 21
L-H1462 (0701)

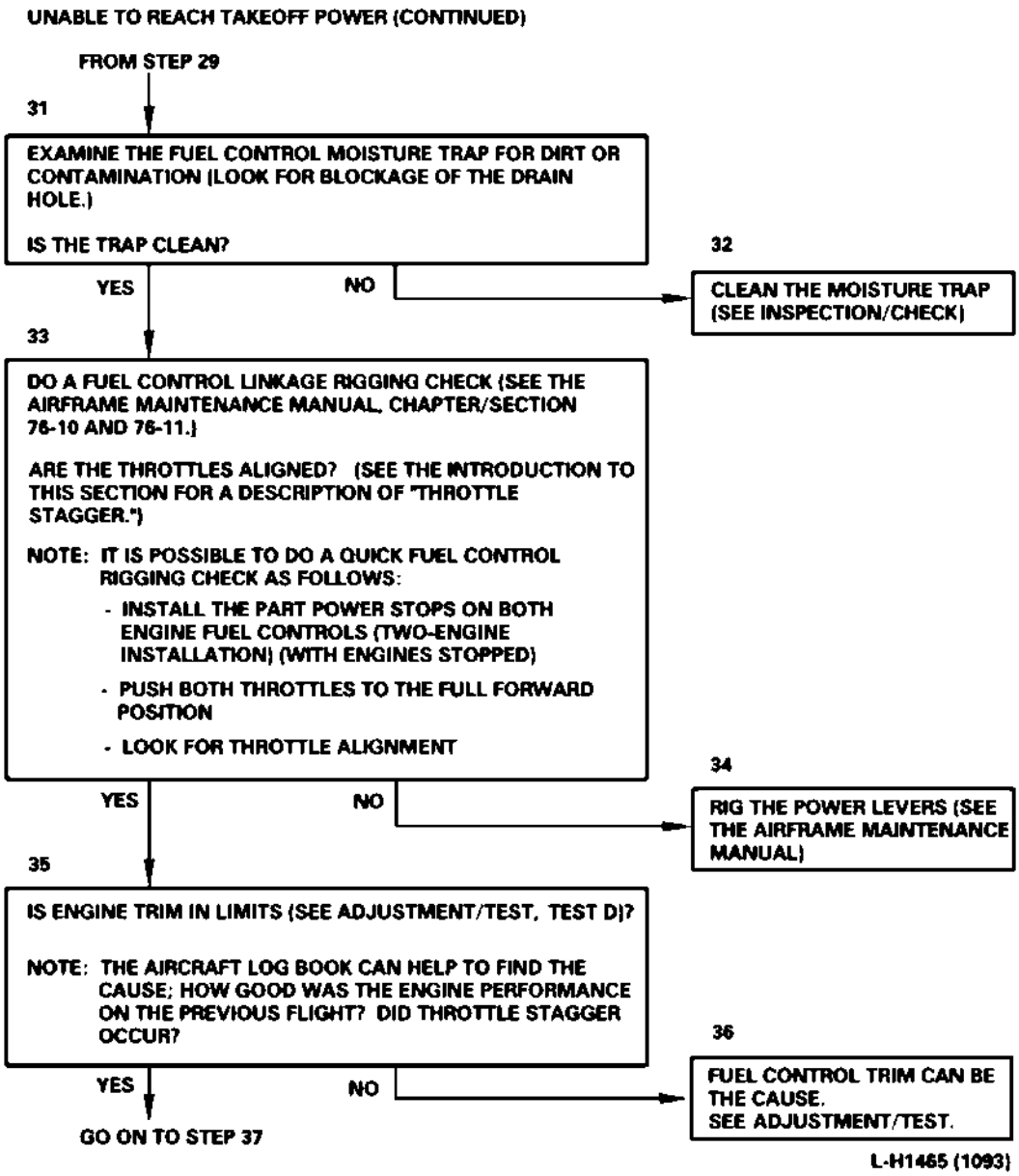
Unable To Reach Takeoff
Power Troubleshooting
Figure 115 (Sheet 4)
(Task 72-00-00-810-006)


UNABLE TO REACH TAKEOFF POWER (CONTINUED)
FROM STEP 19
21
EXAMINE THE AIRCRAFT SERVICE BLEED AIR SYSTEM FOR CORRECT OPERATION OR LEAKS (SEE THE APPLICABLE AIRFRAME MAINTENANCE MANUAL.)
DO THE SERVICE BLEEDS OPERATE CORRECTLY?
YES
NO
22
REPAIR THE SYSTEM (SEE THE AIRFRAME MANUAL)
23
DOES THE ENGINE HAVE A 13TH STAGE START BLEED SYSTEM (POST-SB 5425)?
YES
NO
24
GO ON TO STEP 29
25
DO A CHECK OF THE 13TH STAGE START BLEED VALVE FOR CORRECT OPERATION AS FOLLOWS:
NOTE: FOR A QUICK VISUAL CHECK TO SEE IF THE ENGINE HAS A 13TH STAGE START BLEED SYSTEM (POST-SB 5425), LOOK TO SEE IF THE ENGINE HAS A START BLEED CONTROL VALVE FORWARD AND ABOVE THE PRBC. SEE FIGURE 117.
- DISCONNECT THE UPPER PS4 SUPPLY TUBE FROM THE START BLEED CONTROL VALVE.
- PUT MOUTH PRESSURE (SUCTION AND PRESSURE) SLOWLY IN THE TUBE (OR THE FITTING ON THE DIFFUSER OUTER FAN DUCT) TO MAKE THE START BLEED VALVE OPEN AND CLOSE.
- LISTEN FOR THE NOISE OF THE VALVE (USE A STETHOSCOPE AS NECESSARY.)
DOES THE VALVE OPEN AND CLOSE?
YES
NO
26
LUBRICATE THE BLEED VALVE. SEE 75-30-00, INSPECTION/CHECK -01.
GO ON TO STEP 27
L-H1463 (0701)

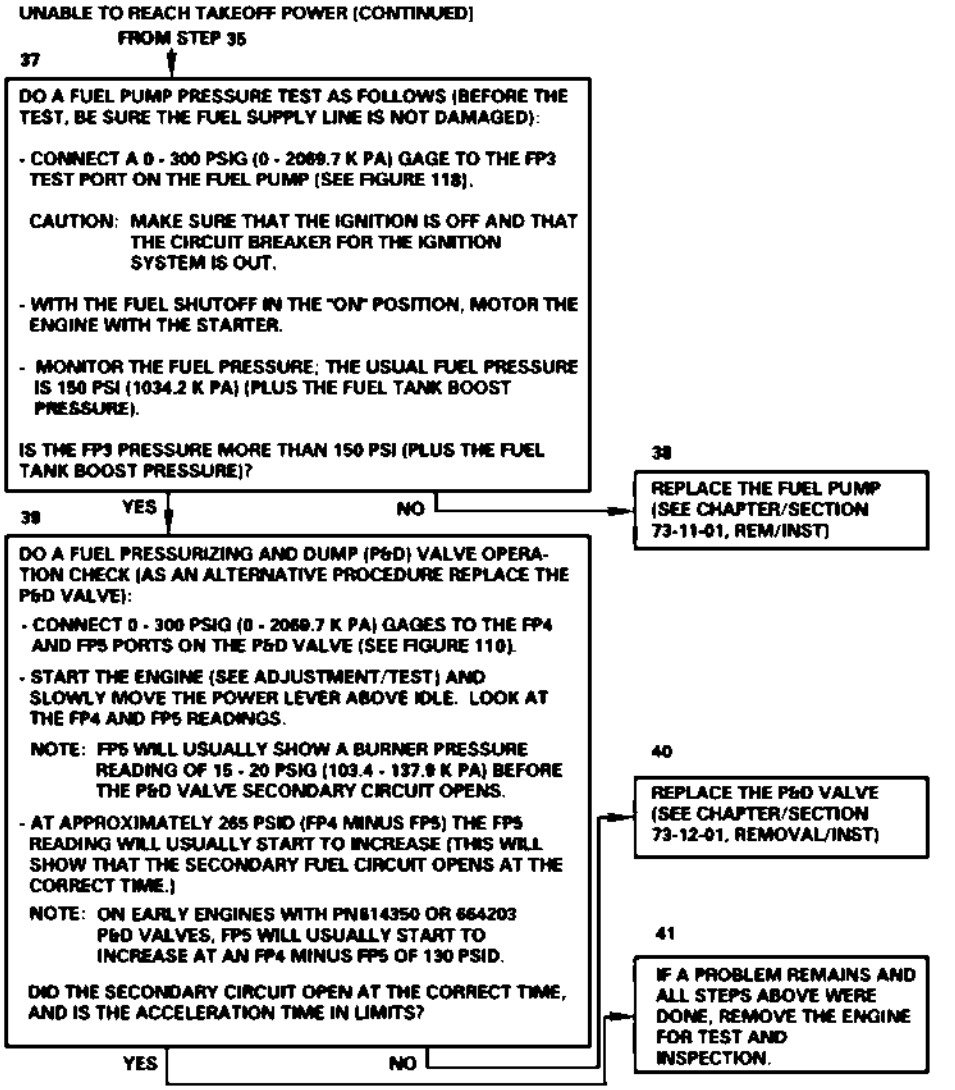
Unable To Reach Takeoff
Power Troubleshooting
Figure 115 (Sheet 5)
(Task 72-00-00-810-006)


UNABLE TO REACH TAKEOFF POWER (CONTINUED)
FROM STEP 25
27
DISCONNECT THE UPPER PS4 SUPPLY TUBE FROM THE START BLEED CONTROL VALVE AND CONNECT A 0 - 30 PSIG (0 - 206.8 K PA) GAGE BETWEEN THE VALVE AND THE TUBE AS SHOWN IN FIGURE 117.
START THE ENGINE (OR USE REGULATED AIR OR NITROGEN TO PRESSURIZE THE VALVE). THE VALVE USUALLY OPENS BETWEEN 17 - 25 PSI (117.2 - 172.4 K PA).
SHUT DOWN THE ENGINE (OR DECREASE TEST PRESSURE UNTIL THE VALVE CLOSES (THIS USUALLY OCCURS BETWEEN 11 - 4 PSI (75.8 - 27.6 K PA.)
NOTE: AIR WILL COME OUT OF THE VALVE VENT HOLES FOR A SHORT TIME WHEN THE VALVE OPENS OR CLOSES.
AS AN ALTERNATIVE PROCEDURE TO SEE IF THE VALVE IS OPEN OR CLOSED, PUT A PIN IN ONE OF THE VENT HOLES (SEE FIGURE 117). AT IDLE, THE DEPTH OF THE HOLE WILL BE 9/16 INCH (14.288 MM). WHILE THE ENGINE OPERATES THE DEPTH WILL BE 5/8 INCH (15.875 MM). PRE-SB 5827 THE DEPTH WILL BE 1/4 INCH (6.350 MM) AT IDLE AND 5/16 INCH (7.937 MM) WHILE THE ENGINE OPERATES.
DOES THE VALVE OPERATE CORRECTLY?
YES
NO
28
REPLACE THE START BLEED CONTROL VALVE (SB 5827 IS RECOMMENDED) SEE CHAPTER/SECTION 75-31-31, REMOVAL/ INSTALLATION
29
LOOK FOR LEAKS IN THE FUEL CONTROL REAR PB TUBE.
IS THE LINE BROKEN, OR ARE CONNECTIONS LOOSE?
NO
YES
30
REPAIR OR TIGHTEN THE TUBE
GO ON TO STEP 31
L-H1464 (0701)

Unable To Reach Takeoff
Power Troubleshooting
Figure 115 (Sheet 6)
(Task 72-00-00-810-006)

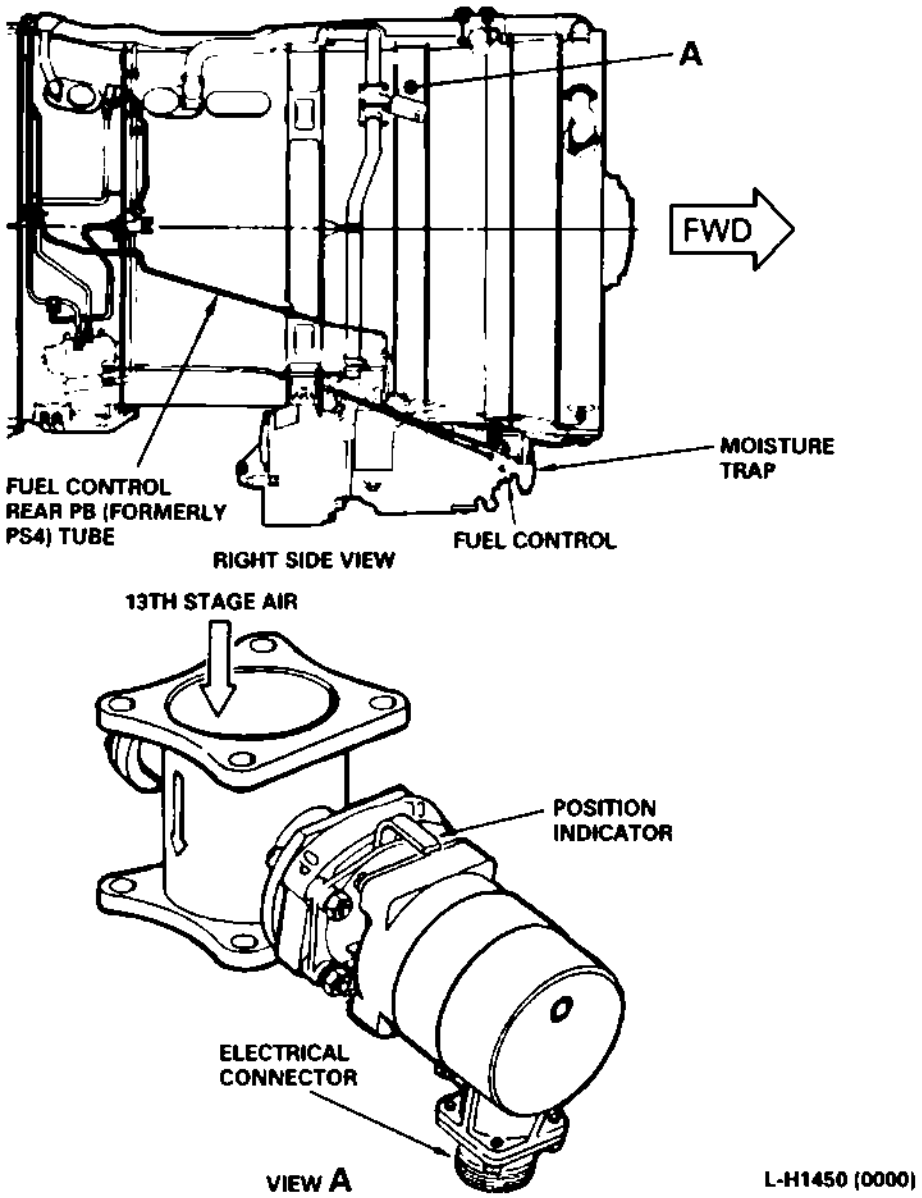

UNABLE TO REACH TAKEOFF POWER (CONTINUED)
FROM STEP 29
31
EXAMINE THE FUEL CONTROL MOISTURE TRAP FOR DIRT OR CONTAMINATION (LOOK FOR BLOCKAGE OF THE DRAIN HOLE.)
IS THE TRAP CLEAN?
YES
NO
32
CLEAN THE MOISTURE TRAP (SEE INSPECTION/CHECK)
33
DO A FUEL CONTROL LINKAGE RIGGING CHECK (SEE THE AIRFRAME MAINTENANCE MANUAL, CHAPTER/SECTION 76-10 AND 76-11.)
ARE THE THROTTLES ALIGNED? (SEE THE INTRODUCTION TO THIS SECTION FOR A DESCRIPTION OF "THROTTLE STAGGER.")
NOTE: IT IS POSSIBLE TO DO A QUICK FUEL CONTROL RIGGING CHECK AS FOLLOWS:
- INSTALL THE PART POWER STOPS ON BOTH ENGINE FUEL CONTROLS (TWO-ENGINE INSTALLATION) (WITH ENGINES STOPPED)
- PUSH BOTH THROTTLES TO THE FULL FORWARD POSITION
- LOOK FOR THROTTLE ALIGNMENT
YES
NO
34
RIG THE POWER LEVERS (SEE THE AIRFRAME MAINTENANCE MANUAL)
35
IS ENGINE TRIM IN LIMITS (SEE ADJUSTMENT/TEST, TEST D)?
NOTE: THE AIRCRAFT LOG BOOK CAN HELP TO FIND THE CAUSE; HOW GOOD WAS THE ENGINE PERFORMANCE ON THE PREVIOUS FLIGHT? DID THROTTLE STAGGER OCCUR?
YES
NO
36
FUEL CONTROL TRIM CAN BE THE CAUSE.
SEE ADJUSTMENT/TEST.
GO ON TO STEP 37
L-H1465 (1093)

Unable To Reach Takeoff
Power Troubleshooting
Figure 115 (Sheet 7)
(Task 72-00-00-810-006)

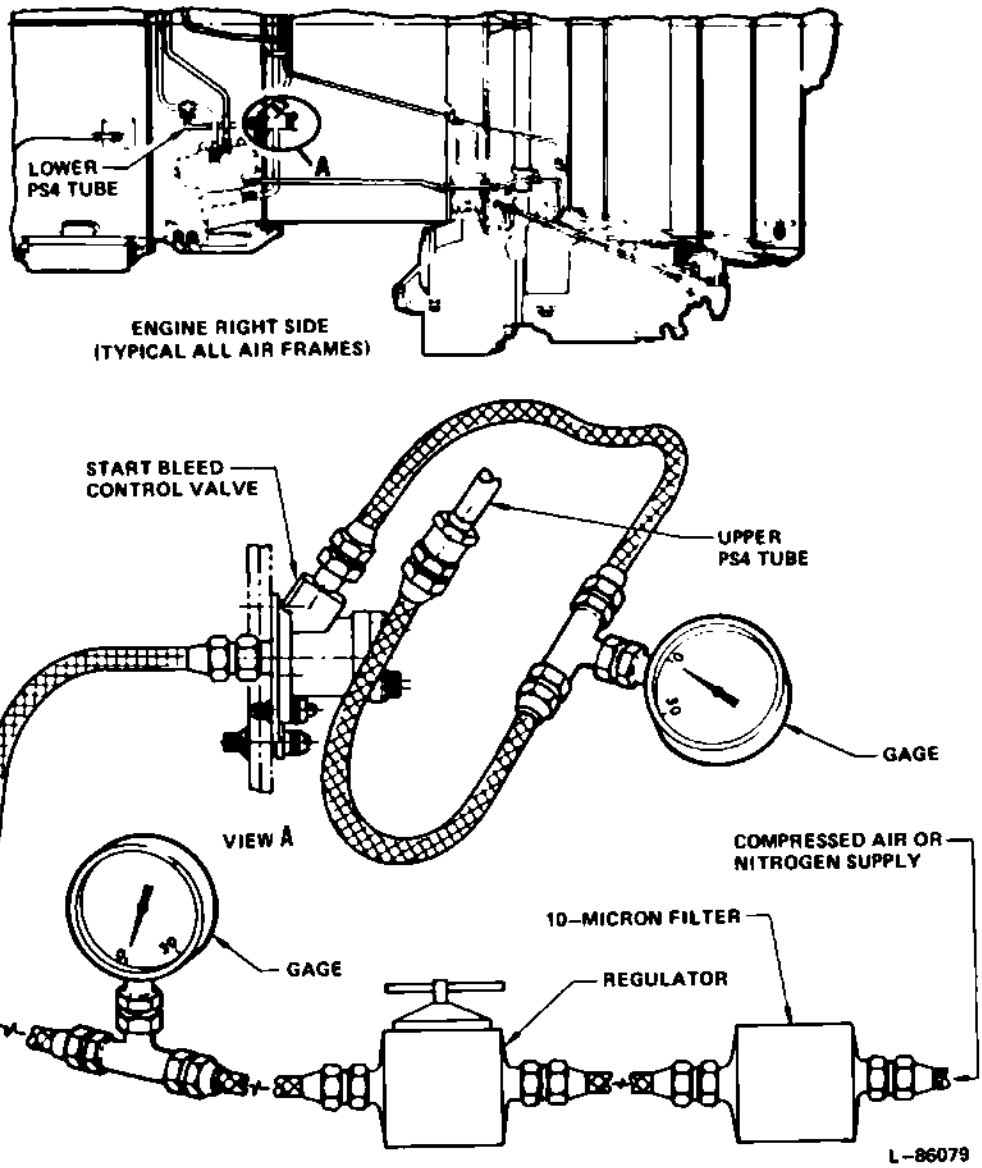

UNABLE TO REACH TAKEOFF POWER (CONTINUED)
FROM STEP 35
37
DO A FUEL PUMP PRESSURE TEST AS FOLLOWS (BEFORE THE TEST, BE SURE THE FUEL SUPPLY LINE IS NOT DAMAGED):
- CONNECT A 0 - 300 PSIG (0 - 2069.7 K PA) GAGE TO THE FP3 TEST PORT ON THE FUEL PUMP (SEE FIGURE 118).
CAUTION: MAKE SURE THAT THE IGNITION IS OFF AND THAT THE CIRCUIT BREAKER FOR THE IGNITION SYSTEM IS OUT.
- WITH THE FUEL SHUTOFF IN THE "ON" POSITION, MOTOR THE ENGINE WITH THE STARTER.
- MONITOR THE FUEL PRESSURE; THE USUAL FUEL PRESSURE IS 150 PSI (1034.2 K PA) (PLUS THE FUEL TANK BOOST PRESSURE).
IS THE FP3 PRESSURE MORE THAN 150 PSI (PLUS THE FUEL TANK BOOST PRESSURE)?
YES
NO
38
REPLACE THE FUEL PUMP (SEE CHAPTER/SECTION 73-11-01, REM/INST)
38
DO A FUEL PRESSURIZING AND DUMP (P&D) VALVE OPERATION CHECK (AS AN ALTERNATIVE PROCEDURE REPLACE THE P&D VALVE):
- CONNECT 0 - 300 PSIG (0 - 2069.7 K PA) GAGES TO THE FP4 AND FP5 PORTS ON THE P&D VALVE (SEE FIGURE 110).
- START THE ENGINE (SEE ADJUSTMENT/TEST) AND SLOWLY MOVE THE POWER LEVER ABOVE IDLE. LOOK AT THE FP4 AND FP5 READINGS.
NOTE: FP5 WILL USUALLY SHOW A BURNER PRESSURE READING OF 15 - 20 PSIG (103.4 - 137.9 K PA) BEFORE THE P&D VALVE SECONDARY CIRCUIT OPENS.
- AT APPROXIMATELY 265 PSID (FP4 MINUS FP5) THE FP5 READING WILL USUALLY START TO INCREASE (THIS WILL SHOW THAT THE SECONDARY FUEL CIRCUIT OPENS AT THE CORRECT TIME.)
NOTE: ON EARLY ENGINES WITH PN814350 OR 664203 P&D VALVES, FP5 WILL USUALLY START TO INCREASE AT AN FP4 MINUS FP5 OF 130 PSID.
DID THE SECONDARY CIRCUIT OPEN AT THE CORRECT TIME, AND IS THE ACCELERATION TIME IN LIMITS?
YES
NO
40
REPLACE THE P&D VALVE (SEE CHAPTER/SECTION 73-12-01, REMOVAL/INST)
41
IF A PROBLEM REMAINS AND ALL STEPS ABOVE WERE DONE, REMOVE THE ENGINE FOR TEST AND INSPECTION.

L-H1466 (0102)

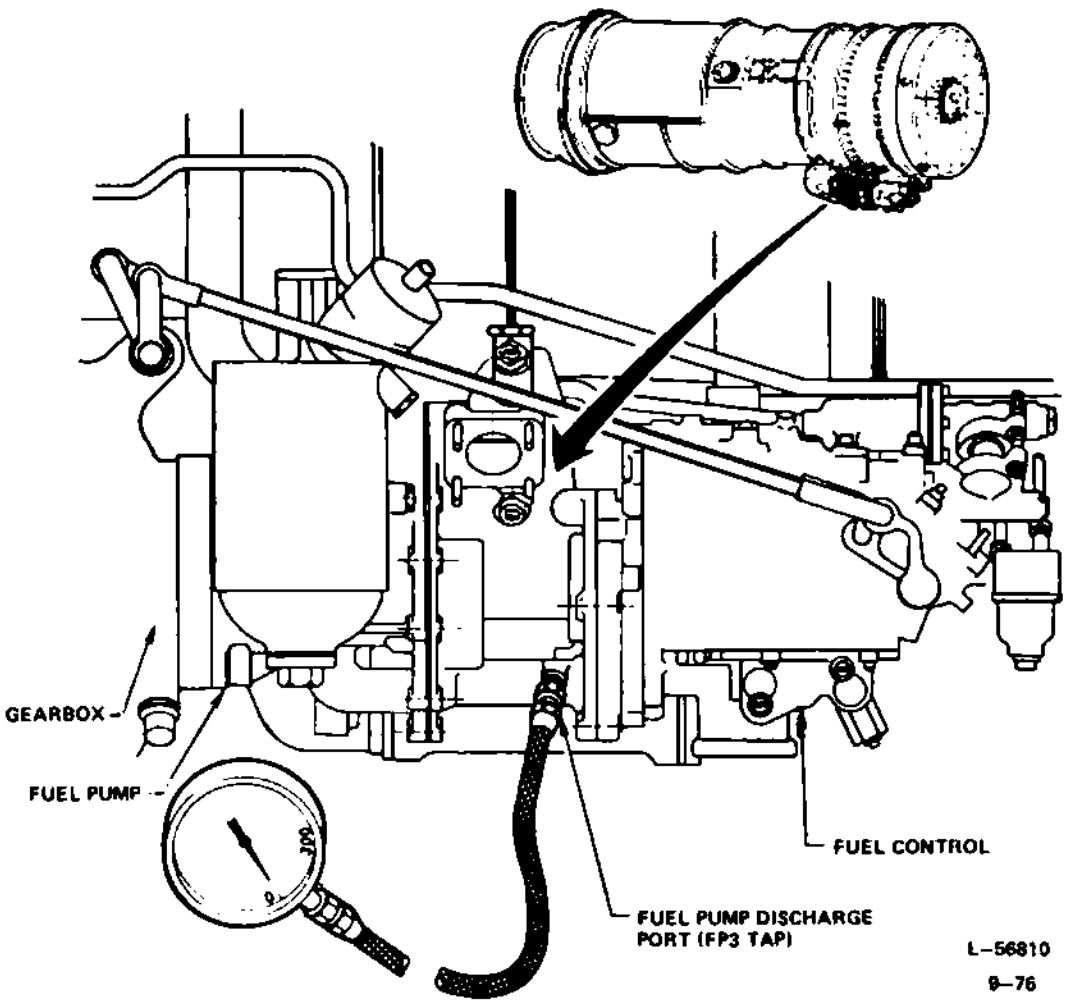
Unable To Reach Takeoff
Power Troubleshooting
Figure 115 (Sheet 8)
(Task 72-00-00-810-006)



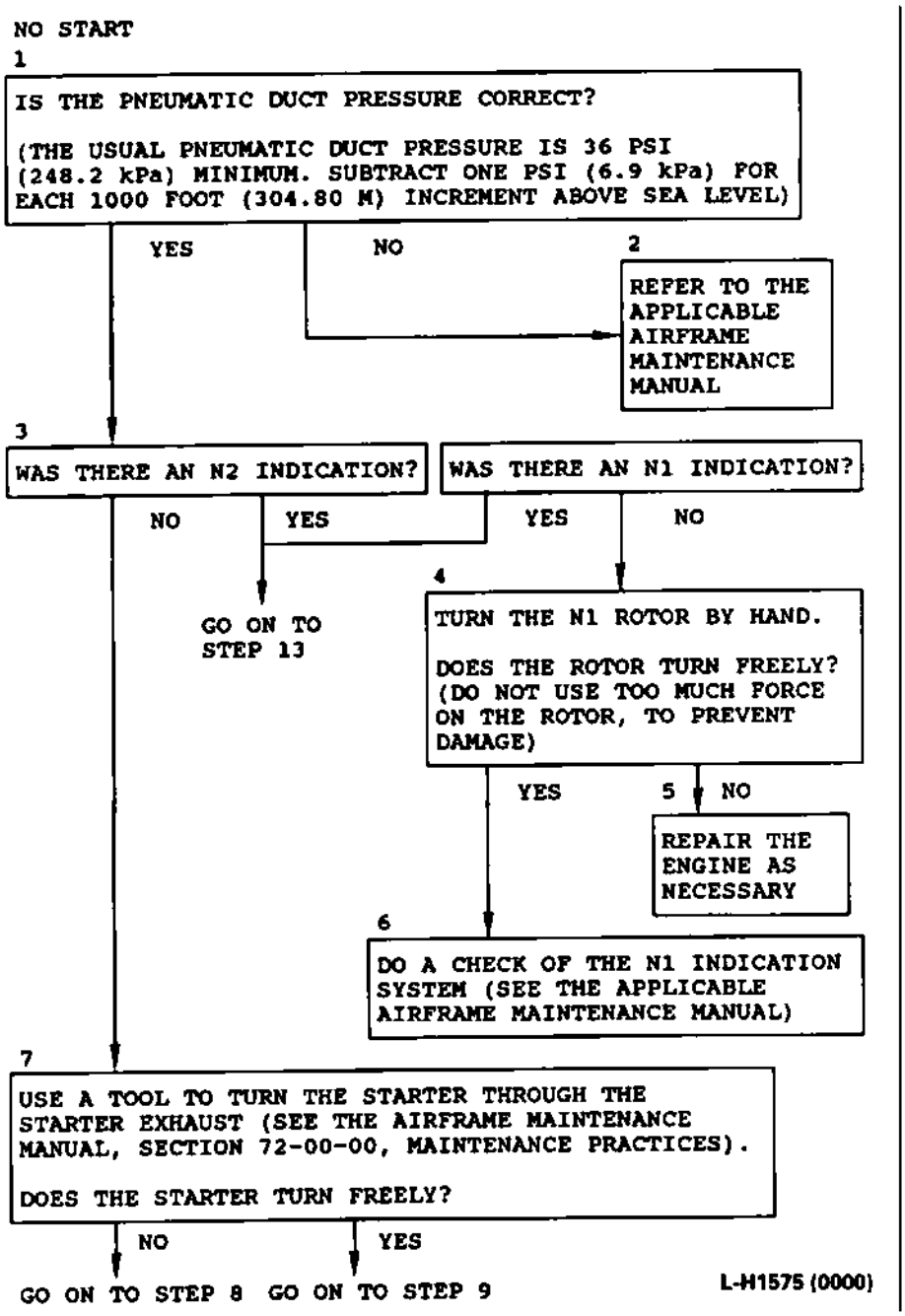
Fuel Deicing System Check
Figure 116
(Task 72-00-00-810-006)



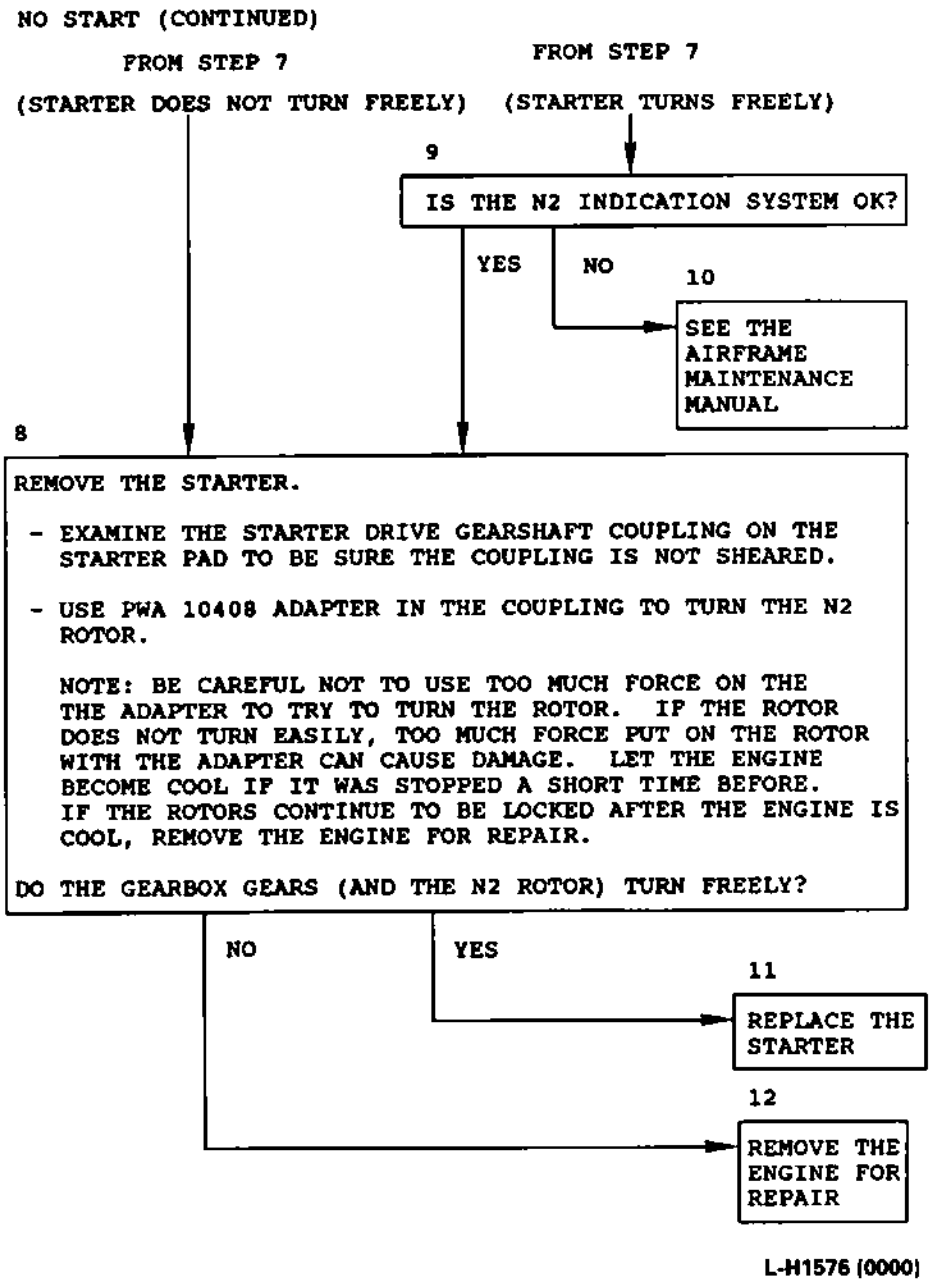
Start Bleed Control Valve Check
Figure 117
(Task 72-00-00-810-006)



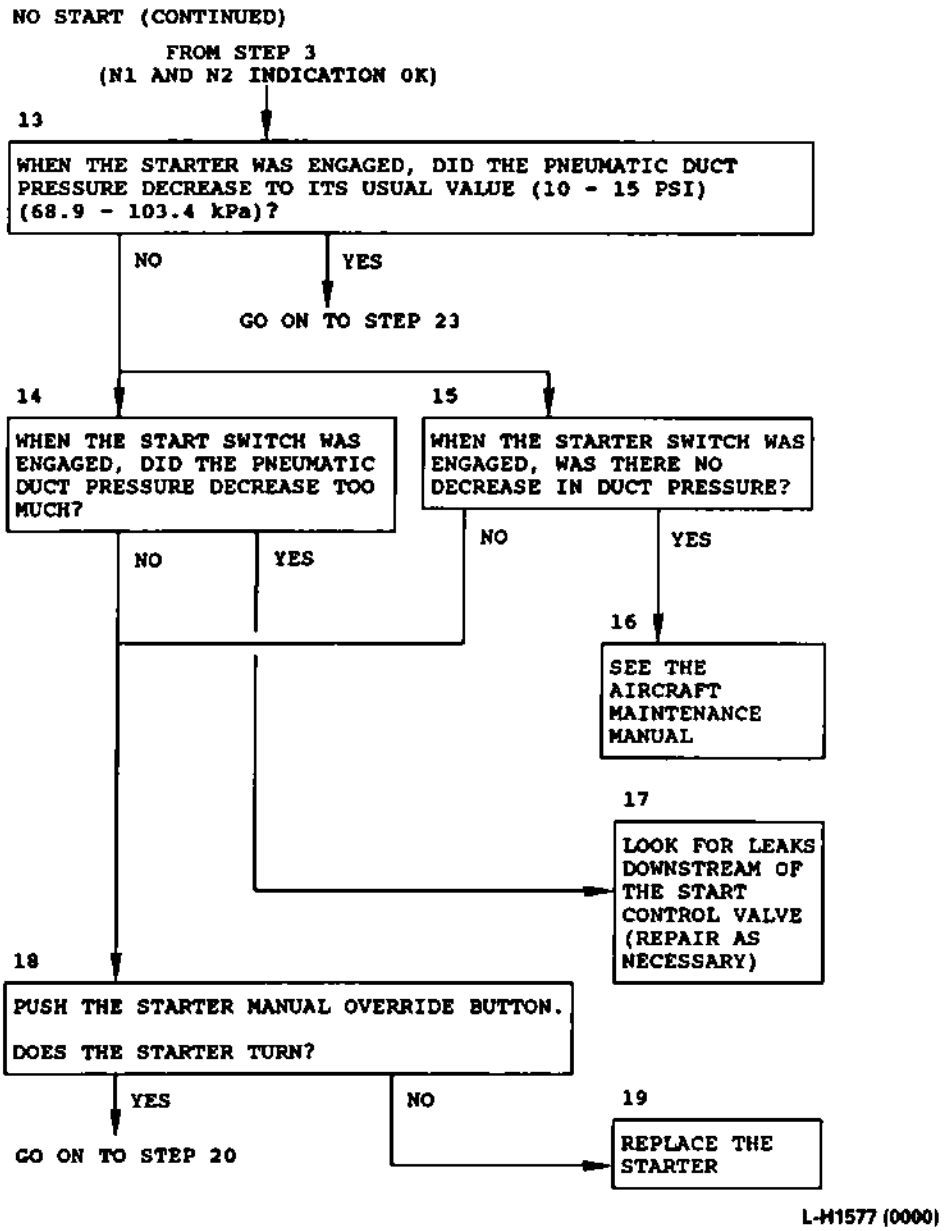
Fuel Pump Output Check
Figure 118
(Task 72-00-00-810-006)


NO START
1
IS THE PNEUMATIC DUCT PRESSURE CORRECT?
(THE USUAL PNEUMATIC DUCT PRESSURE IS 36 PSI (248.2 kPa) MINIMUM. SUBTRACT ONE PSI (6.9 kPa) FOR EACH 1000 FOOT (304.80 M) INCREMENT ABOVE SEA LEVEL)
YES
NO
2
REFER TO THE APPLICABLE AIRFRAME MAINTENANCE MANUAL
3
WAS THERE AN N2 INDICATION?
WAS THERE AN N1 INDICATION?
NO
YES
YES
NO
GO ON TO STEP 13
4
TURN THE N1 ROTOR BY HAND.
DOES THE ROTOR TURN FREELY? (DO NOT USE TOO MUCH FORCE ON THE ROTOR, TO PREVENT DAMAGE)
YES
5
NO
REPAIR THE ENGINE AS NECESSARY
6
DO A CHECK OF THE N1 INDICATION SYSTEM (SEE THE APPLICABLE AIRFRAME MAINTENANCE MANUAL)
7
USE A TOOL TO TURN THE STARTER THROUGH THE STARTER EXHAUST (SEE THE AIRFRAME MAINTENANCE MANUAL, SECTION 72-00-00, MAINTENANCE PRACTICES).
DOES THE STARTER TURN FREELY?
NO
YES
GO ON TO STEP 8
GO ON TO STEP 9
L-H1575 (0000)

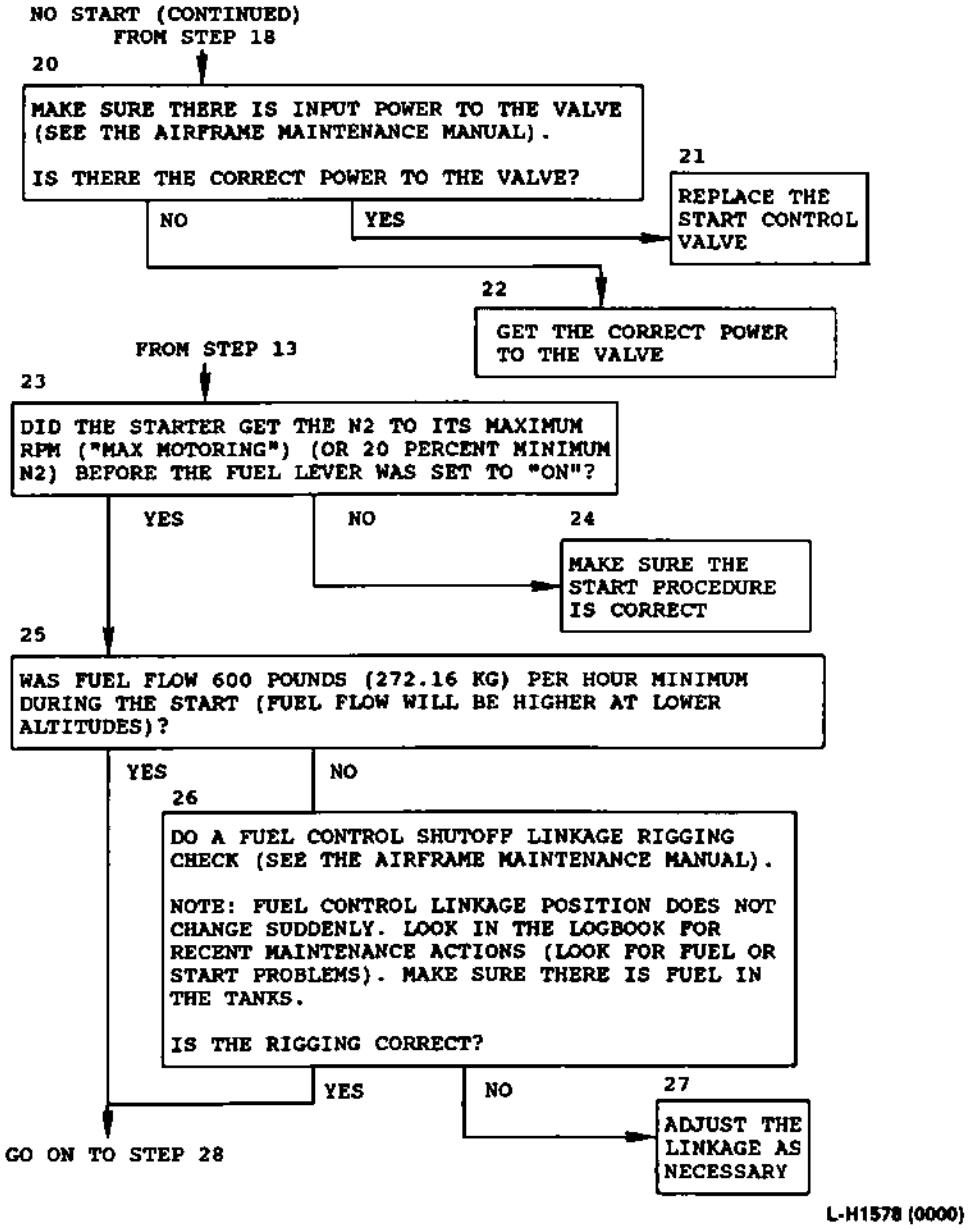
No Start Troubleshooting
Figure 119 (Sheet 1)
(Task 72-00-00-810-006)


NO START (CONTINUED)
FROM STEP 7
(STARTER DOES NOT TURN FREELY)
FROM STEP 7
(STARTER TURNS FREELY)
9
IS THE N2 INDICATION SYSTEM OK?
YES
NO
10
SEE THE AIRFRAME MAINTENANCE MANUAL
8
REMOVE THE STARTER.
- EXAMINE THE STARTER DRIVE GEARSHAFT COUPLING ON THE STARTER PAD TO BE SURE THE COUPLING IS NOT SHEARED.
- USE PWA 10408 ADAPTER IN THE COUPLING TO TURN THE N2 ROTOR.
NOTE: BE CAREFUL NOT TO USE TOO MUCH FORCE ON THE THE ADAPTER TO TRY TO TURN THE ROTOR. IF THE ROTOR DOES NOT TURN EASILY, TOO MUCH FORCE PUT ON THE ROTOR WITH THE ADAPTER CAN CAUSE DAMAGE. LET THE ENGINE BECOME COOL IF IT WAS STOPPED A SHORT TIME BEFORE. IF THE ROTORS CONTINUE TO BE LOCKED AFTER THE ENGINE IS COOL, REMOVE THE ENGINE FOR REPAIR.
DO THE GEARBOX GEARS (AND THE N2 ROTOR) TURN FREELY?
NO
YES
11
REPLACE THE STARTER
12
REMOVE THE ENGINE FOR REPAIR
L-H1576 (0000)

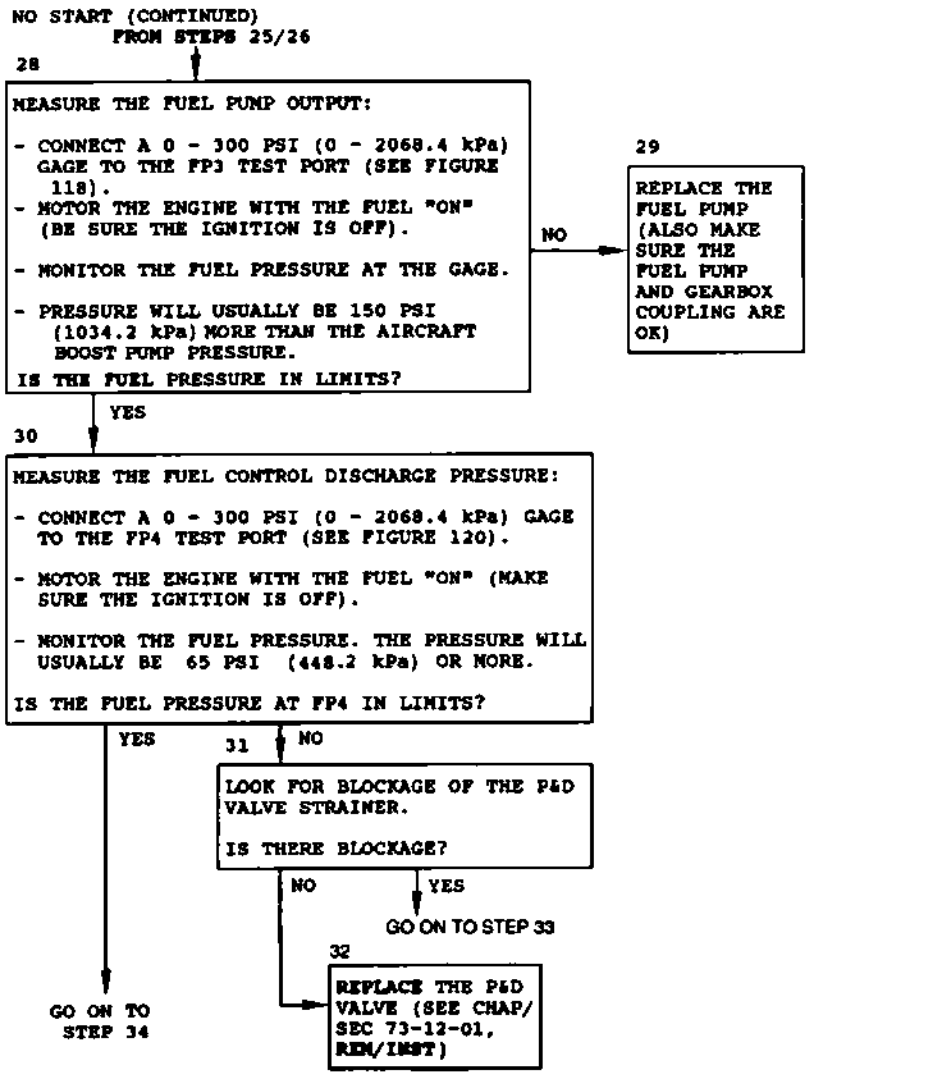
No Start Troubleshooting
Figure 119 (Sheet 2)
(Task 72-00-00-810-006)


NO START (CONTINUED)
FROM STEP 3
(N1 AND N2 INDICATION OK)
13
WHEN THE STARTER WAS ENGAGED, DID THE PNEUMATIC DUCT PRESSURE DECREASE TO ITS USUAL VALUE (10 - 15 PSI) (68.9 - 103.4 kPa)?
NO
YES
GO ON TO STEP 23
14
WHEN THE START SWITCH WAS ENGAGED, DID THE PNEUMATIC DUCT PRESSURE DECREASE TOO MUCH?
NO
YES
15
WHEN THE STARTER SWITCH WAS ENGAGED, WAS THERE NO DECREASE IN DUCT PRESSURE?
NO
YES
16
SEE THE AIRCRAFT MAINTENANCE MANUAL
17
LOOK FOR LEAKS DOWNSTREAM OF THE START CONTROL VALVE (REPAIR AS NECESSARY)
18
PUSH THE STARTER MANUAL OVERRIDE BUTTON.
DOES THE STARTER TURN?
YES
GO ON TO STEP 20
NO
19
REPLACE THE STARTER
L-H1577 (0000)

No Start Troubleshooting
Figure 119 (Sheet 3)
(Task 72-00-00-810-006)

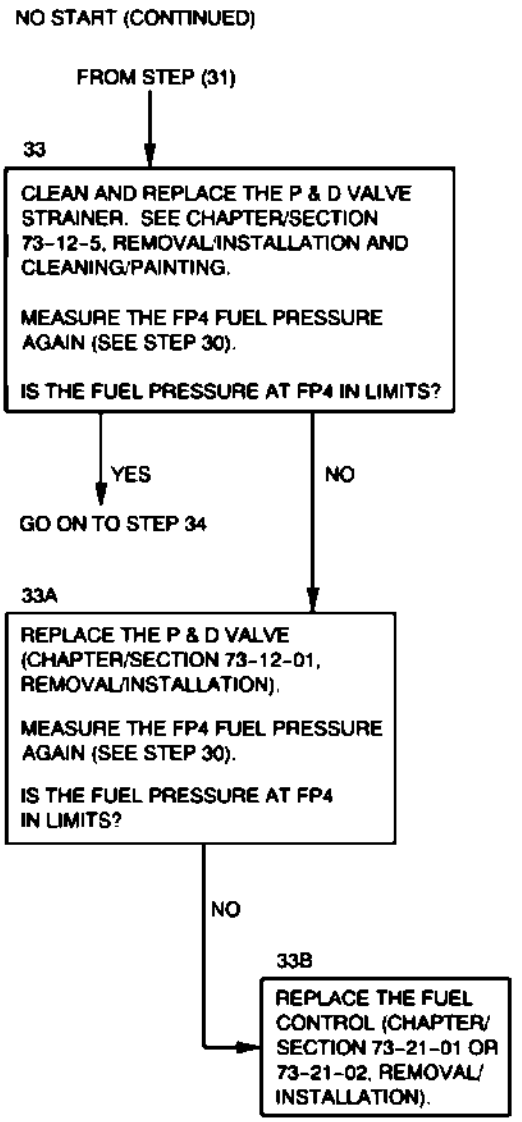

NO START (CONTINUED)
FROM STEP 18
20
MAKE SURE THERE IS INPUT POWER TO THE VALVE (SEE THE AIRFRAME MAINTENANCE MANUAL).
IS THERE THE CORRECT POWER TO THE VALVE?
NO
YES
21
REPLACE THE START CONTROL VALVE
22
GET THE CORRECT POWER TO THE VALVE
FROM STEP 13
23
DID THE STARTER GET THE N2 TO ITS MAXIMUM RPM ("MAX MOTORING") (OR 20 PERCENT MINIMUM N2) BEFORE THE FUEL LEVER WAS SET TO "ON"?
YES
NO
24
MAKE SURE THE START PROCEDURE IS CORRECT
25
WAS FUEL FLOW 600 POUNDS (272.16 KG) PER HOUR MINIMUM DURING THE START (FUEL FLOW WILL BE HIGHER AT LOWER ALTITUDES)?
YES
NO
26
DO A FUEL CONTROL SHUTOFF LINKAGE RIGGING CHECK (SEE THE AIRFRAME MAINTENANCE MANUAL).
NOTE: FUEL CONTROL LINKAGE POSITION DOES NOT CHANGE SUDDENLY. LOOK IN THE LOGBOOK FOR RECENT MAINTENANCE ACTIONS (LOOK FOR FUEL OR START PROBLEMS). MAKE SURE THERE IS FUEL IN THE TANKS.
IS THE RIGGING CORRECT?
YES
NO
27
ADJUST THE LINKAGE AS NECESSARY
GO ON TO STEP 28
L-H1578 (0000)

No Start Troubleshooting
Figure 119 (Sheet 4)
(Task 72-00-00-810-006)


NO START (CONTINUED)
FROM STEPS 25/26
28
MEASURE THE FUEL PUMP OUTPUT:
- CONNECT A 0 - 300 PSI (0 - 2068.4 kPa) GAGE TO THE FP3 TEST PORT (SEE FIGURE 118).
- MOTOR THE ENGINE WITH THE FUEL "ON" (BE SURE THE IGNITION IS OFF).
- MONITOR THE FUEL PRESSURE AT THE GAGE.
- PRESSURE WILL USUALLY BE 150 PSI (1034.2 kPa) MORE THAN THE AIRCRAFT BOOST PUMP PRESSURE.
IS THE FUEL PRESSURE IN LIMITS?
NO
29
REPLACE THE FUEL PUMP (ALSO MAKE SURE THE FUEL PUMP AND GEARBOX COUPLING ARE OK)
YES
30
MEASURE THE FUEL CONTROL DISCHARGE PRESSURE:
- CONNECT A 0 - 300 PSI (0 - 2068.4 kPa) GAGE TO THE FP4 TEST PORT (SEE FIGURE 120).
- MOTOR THE ENGINE WITH THE FUEL "ON" (MAKE SURE THE IGNITION IS OFF).
- MONITOR THE FUEL PRESSURE. THE PRESSURE WILL USUALLY BE 65 PSI (448.2 kPa) OR MORE.
IS THE FUEL PRESSURE AT FP4 IN LIMITS?
YES
NO
31
LOOK FOR BLOCKAGE OF THE P&D VALVE STRAINER.
IS THERE BLOCKAGE?
NO
YES
GO ON TO STEP 33
32
REPLACE THE P&D VALVE (SEE CHAP/SEC 73-12-01, REM/INST)
GO ON TO STEP 34

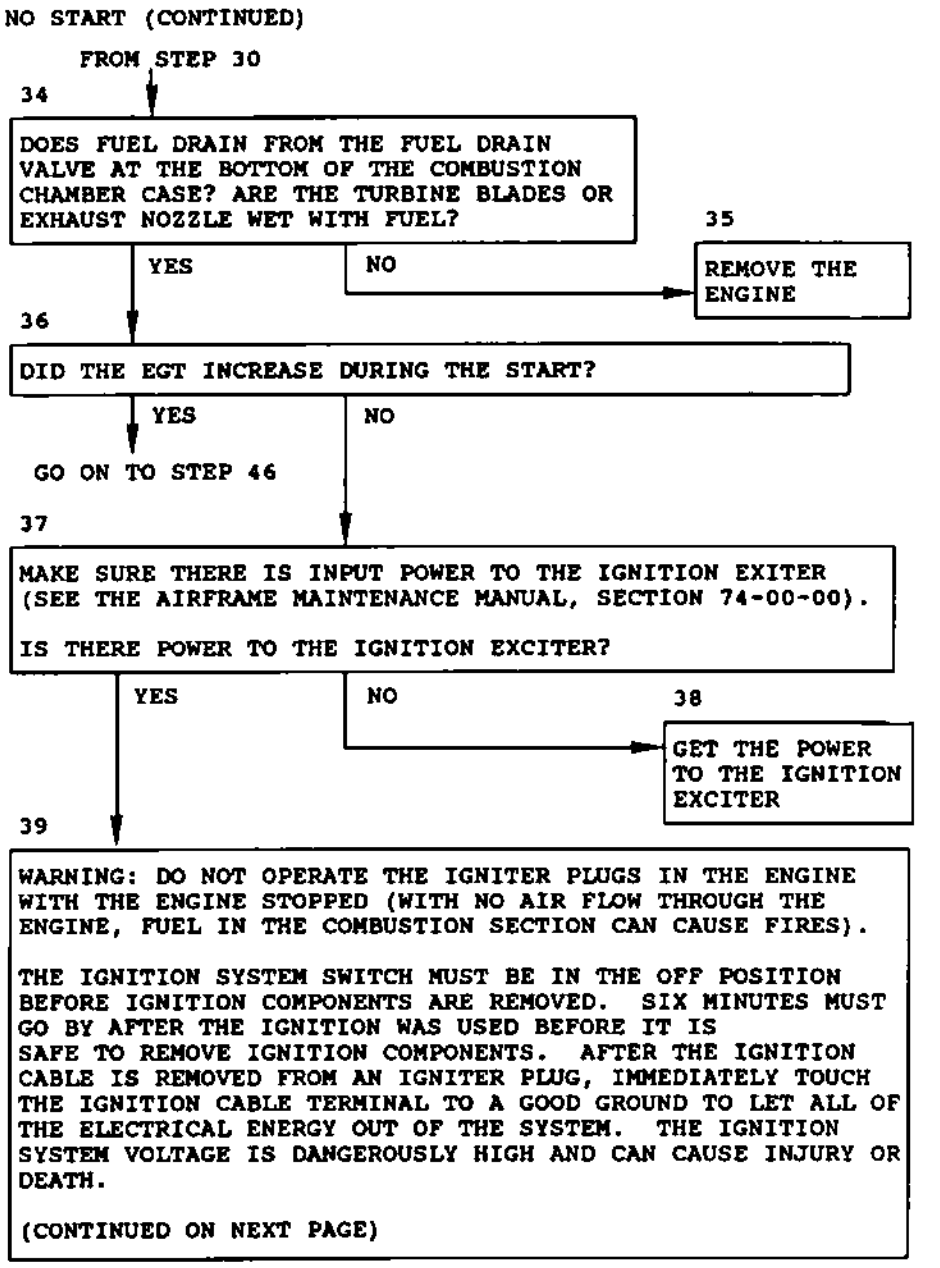
L-H1622 (0102)

No Start Troubleshooting
Figure 119 (Sheet 5)
(Task 72-00-00-810-006)


NO START (CONTINUED)
FROM STEP (31)
33
CLEAN AND REPLACE THE P & D VALVE STRAINER. SEE CHAPTER/SECTION 73-12-5, REMOVAL/INSTALLATION AND CLEANING/PAINTING.
MEASURE THE FP4 FUEL PRESSURE AGAIN (SEE STEP 30).
IS THE FUEL PRESSURE AT FP4 IN LIMITS?
YES
NO
GO ON TO STEP 34
33A
REPLACE THE P & D VALVE (CHAPTER/SECTION 73-12-01, REMOVAL/INSTALLATION).
MEASURE THE FP4 FUEL PRESSURE AGAIN (SEE STEP 30).
IS THE FUEL PRESSURE AT FP4 IN LIMITS?
NO
33B
REPLACE THE FUEL CONTROL (CHAPTER/SECTION 73-21-01 OR 73-21-02, REMOVAL/INSTALLATION).

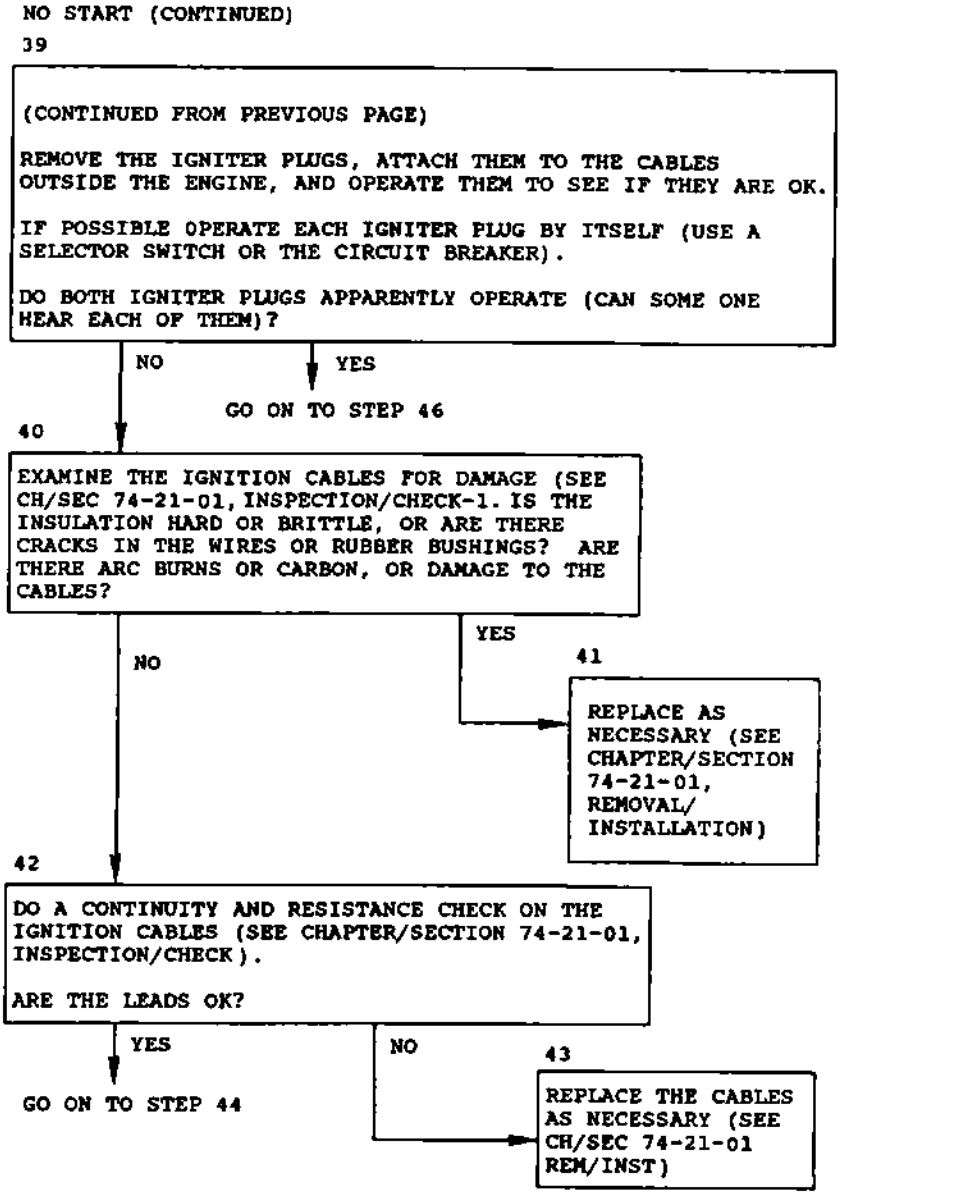
L-H4669 (0102)
PW V

No Start Troubleshooting
Figure 119 (Sheet 6)
(Task 72-00-00-810-006)


NO START (CONTINUED)
FROM STEP 30
34
DOES FUEL DRAIN FROM THE FUEL DRAIN VALVE AT THE BOTTOM OF THE COMBUSTION CHAMBER CASE? ARE THE TURBINE BLADES OR EXHAUST NOZZLE WET WITH FUEL?
YES
NO
35
REMOVE THE ENGINE
36
DID THE EGT INCREASE DURING THE START?
YES
NO
GO ON TO STEP 46
37
MAKE SURE THERE IS INPUT POWER TO THE IGNITION EXITER (SEE THE AIRFRAME MAINTENANCE MANUAL, SECTION 74-00-00).
IS THERE POWER TO THE IGNITION EXCITER?
YES
NO
38
GET THE POWER TO THE IGNITION EXCITER
39
WARNING: DO NOT OPERATE THE IGNITER PLUGS IN THE ENGINE WITH THE ENGINE STOPPED (WITH NO AIR FLOW THROUGH THE ENGINE, FUEL IN THE COMBUSTION SECTION CAN CAUSE FIRES).
THE IGNITION SYSTEM SWITCH MUST BE IN THE OFF POSITION BEFORE IGNITION COMPONENTS ARE REMOVED. SIX MINUTES MUST GO BY AFTER THE IGNITION WAS USED BEFORE IT IS SAFE TO REMOVE IGNITION COMPONENTS. AFTER THE IGNITION CABLE IS REMOVED FROM AN IGNITER PLUG, IMMEDIATELY TOUCH THE IGNITION CABLE TERMINAL TO A GOOD GROUND TO LET ALL OF THE ELECTRICAL ENERGY OUT OF THE SYSTEM. THE IGNITION SYSTEM VOLTAGE IS DANGEROUSLY HIGH AND CAN CAUSE INJURY OR DEATH.
(CONTINUED ON NEXT PAGE)

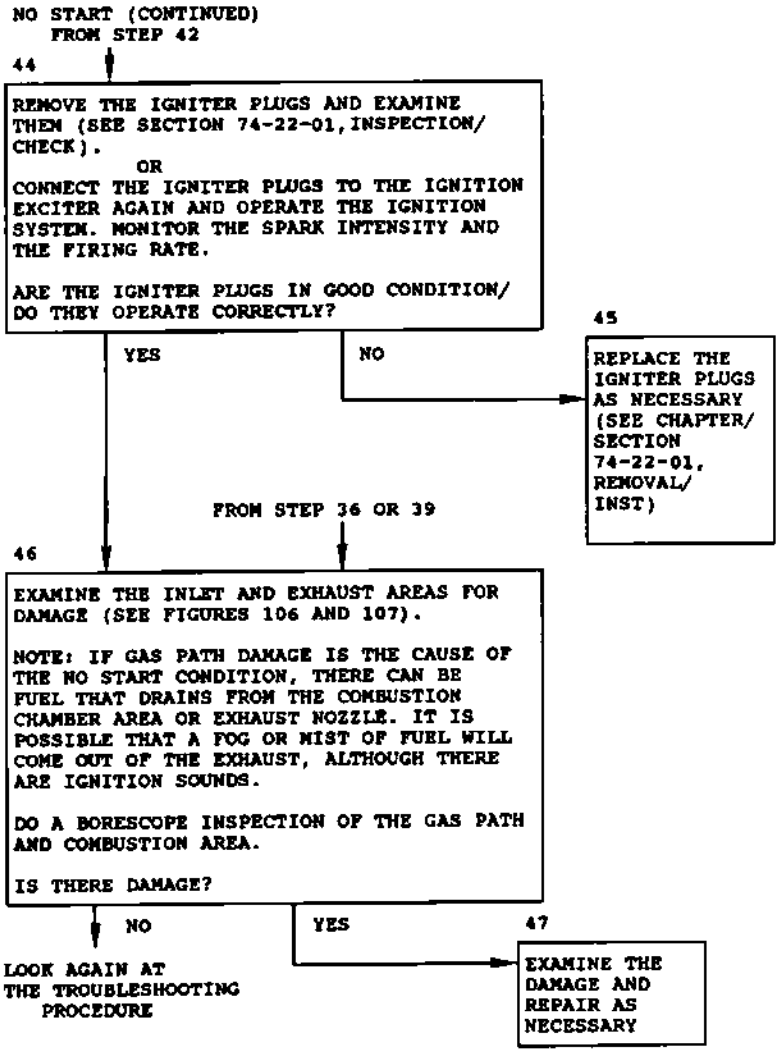
L-H1580 (0000)

No Start Troubleshooting
Figure 119 (Sheet 7)
(Task 72-00-00-810-006)


NO START (CONTINUED)
39
(CONTINUED FROM PREVIOUS PAGE)
REMOVE THE IGNITER PLUGS, ATTACH THEM TO THE CABLES OUTSIDE THE ENGINE, AND OPERATE THEM TO SEE IF THEY ARE OK.
IF POSSIBLE OPERATE EACH IGNITER PLUG BY ITSELF (USE A SELECTOR SWITCH OR THE CIRCUIT BREAKER).
DO BOTH IGNITER PLUGS APPARENTLY OPERATE (CAN SOME ONE HEAR EACH OF THEM)?
NO
YES
GO ON TO STEP 46
40
EXAMINE THE IGNITION CABLES FOR DAMAGE (SEE CH/SEC 74-21-01, INSPECTION/CHECK-1. IS THE INSULATION HARD OR BRITTLE, OR ARE THERE CRACKS IN THE WIRES OR RUBBER BUSHINGS? ARE THERE ARC BURNS OR CARBON, OR DAMAGE TO THE CABLES?
YES
41
REPLACE AS NECESSARY (SEE CHAPTER/SECTION 74-21-01, REMOVAL/ INSTALLATION)
NO
42
DO A CONTINUITY AND RESISTANCE CHECK ON THE IGNITION CABLES (SEE CHAPTER/SECTION 74-21-01, INSPECTION/CHECK).
ARE THE LEADS OK?
YES
GO ON TO STEP 44
NO
43
REPLACE THE CABLES AS NECESSARY (SEE CH/SEC 74-21-01 REM/INST)

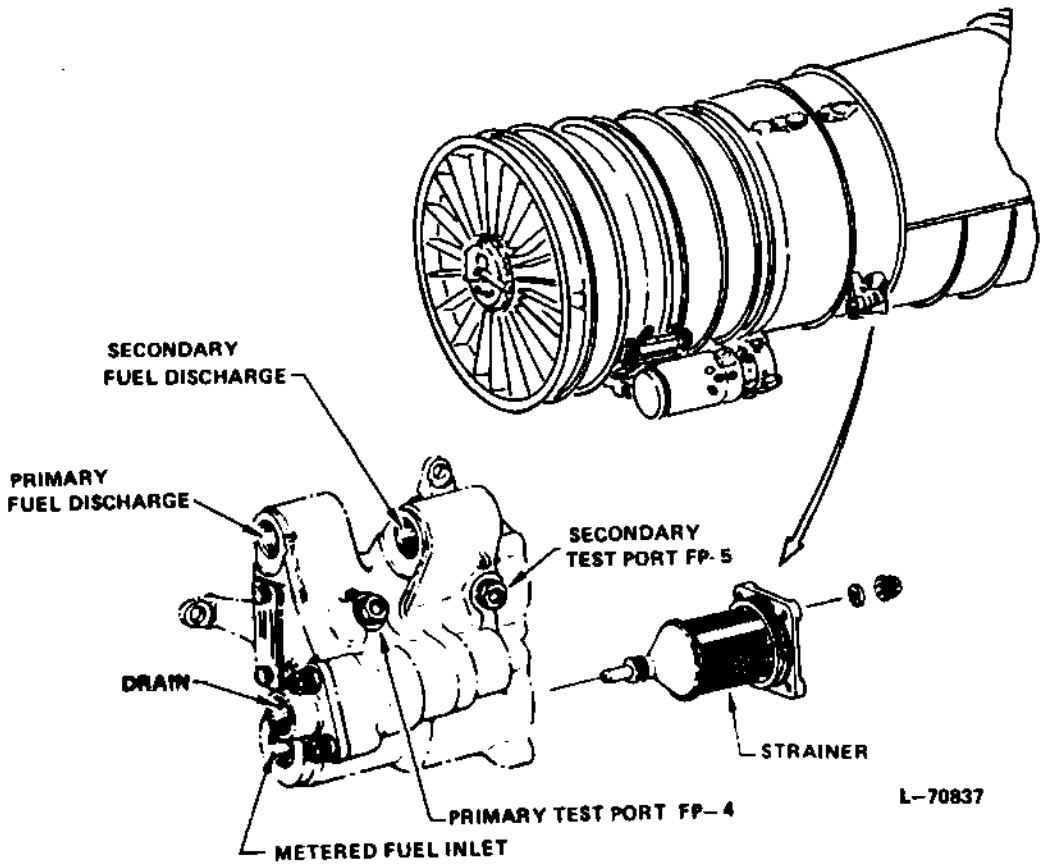
L-H1623 (0102)

No Start Troubleshooting
Figure 119 (Sheet 8)
(Task 72-00-00-810-006)

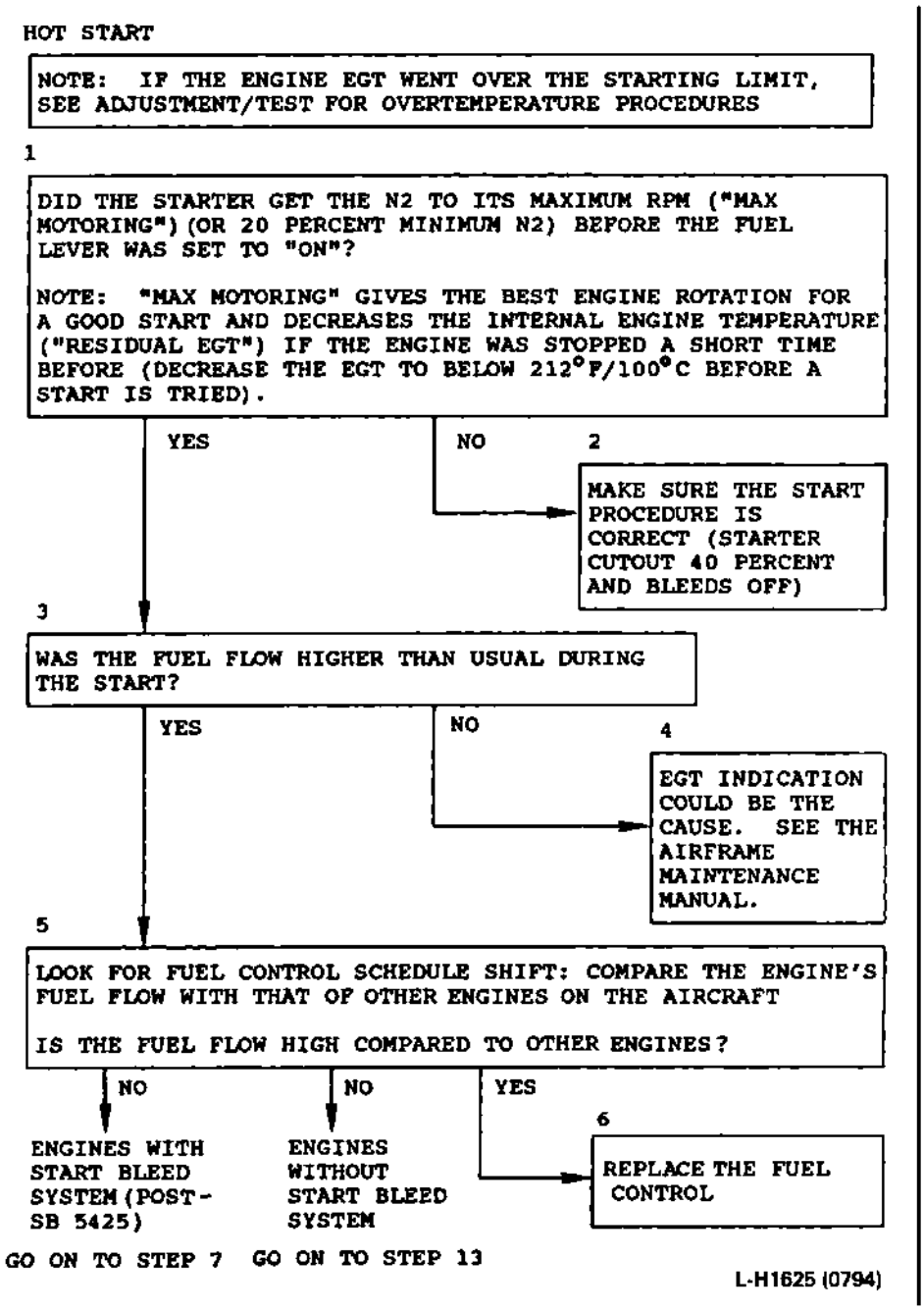

NO START (CONTINUED)
FROM STEP 42
44
REMOVE THE IGNITER PLUGS AND EXAMINE THEM (SEE SECTION 74-22-01, INSPECTION/ CHECK).
OR
CONNECT THE IGNITER PLUGS TO THE IGNITION EXCITER AGAIN AND OPERATE THE IGNITION SYSTEM. MONITOR THE SPARK INTENSITY AND THE FIRING RATE.
ARE THE IGNITER PLUGS IN GOOD CONDITION/ DO THEY OPERATE CORRECTLY?
YES
NO
45
REPLACE THE IGNITER PLUGS AS NECESSARY (SEE CHAPTER/ SECTION 74-22-01, REMOVAL/ INST)
FROM STEP 36 OR 39
46
EXAMINE THE INLET AND EXHAUST AREAS FOR DAMAGE (SEE FIGURES 106 AND 107).
NOTE: IF GAS PATH DAMAGE IS THE CAUSE OF THE NO START CONDITION, THERE CAN BE FUEL THAT DRAINS FROM THE COMBUSTION CHAMBER AREA OR EXHAUST NOZZLE. IT IS POSSIBLE THAT A FOG OR MIST OF FUEL WILL COME OUT OF THE EXHAUST, ALTHOUGH THERE ARE IGNITION SOUNDS.
DO A BORESCOPE INSPECTION OF THE GAS PATH AND COMBUSTION AREA.
IS THERE DAMAGE?
NO
YES
47
EXAMINE THE DAMAGE AND REPAIR AS NECESSARY
LOOK AGAIN AT THE TROUBLESHOOTING PROCEDURE

L-H1624 (0102)

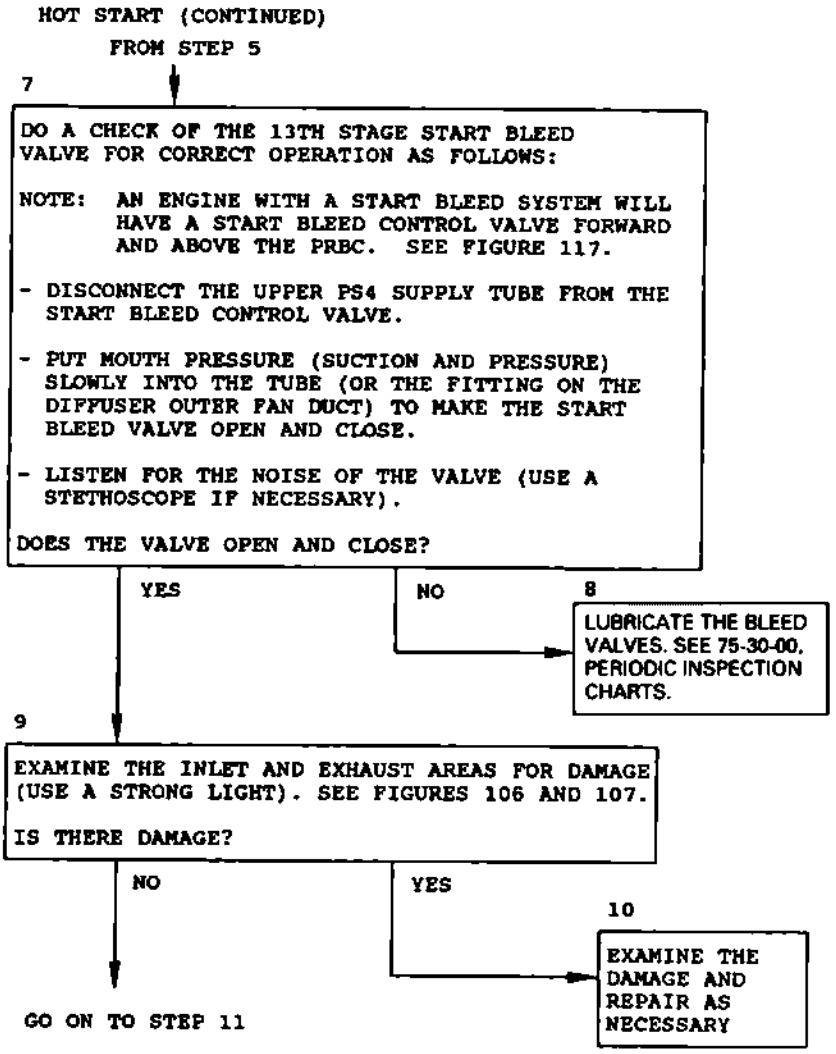
No Start Troubleshooting
Figure 119 (Sheet 9)
(Task 72-00-00-810-006)



Fuel Pressurizing And
Dump Valve Pressure Check
Figure 120
(Task 72-00-00-810-006)

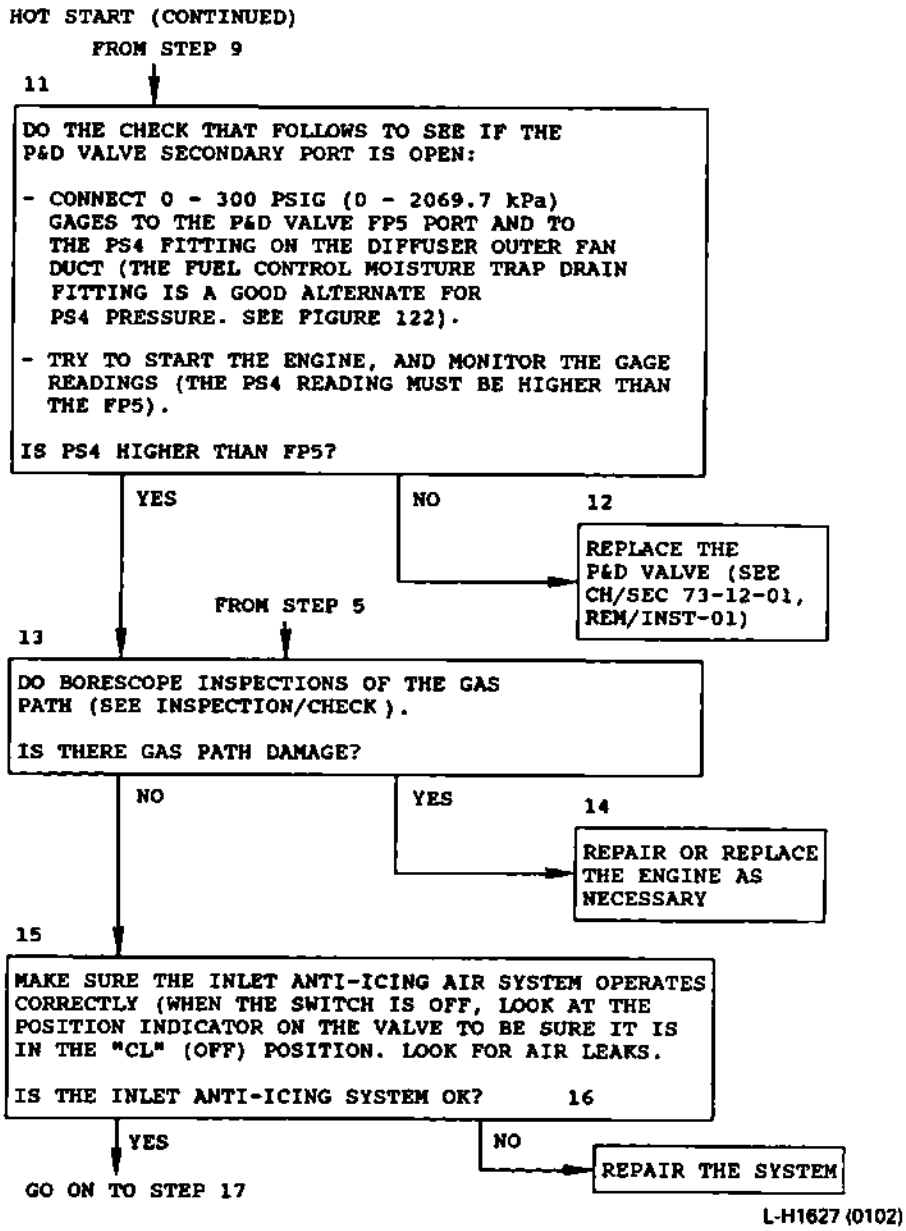

HOT START
NOTE: IF THE ENGINE EGT WENT OVER THE STARTING LIMIT, SEE ADJUSTMENT/TEST FOR OVERTEMPERATURE PROCEDURES
1
DID THE STARTER GET THE N2 TO ITS MAXIMUM RPM ("MAX MOTORING") (OR 20 PERCENT MINIMUM N2) BEFORE THE FUEL LEVER WAS SET TO "ON"?
NOTE: "MAX MOTORING" GIVES THE BEST ENGINE ROTATION FOR A GOOD START AND DECREASES THE INTERNAL ENGINE TEMPERATURE ("RESIDUAL EGT") IF THE ENGINE WAS STOPPED A SHORT TIME BEFORE (DECREASE THE EGT TO BELOW 212°F/100°C BEFORE A START IS TRIED).
YES
NO
2
MAKE SURE THE START PROCEDURE IS CORRECT (STARTER CUTOUT 40 PERCENT AND BLEEDS OFF)
3
WAS THE FUEL FLOW HIGHER THAN USUAL DURING THE START?
YES
NO
4
EGT INDICATION COULD BE THE CAUSE. SEE THE AIRFRAME MAINTENANCE MANUAL.
5
LOOK FOR FUEL CONTROL SCHEDULE SHIFT: COMPARE THE ENGINE'S FUEL FLOW WITH THAT OF OTHER ENGINES ON THE AIRCRAFT
IS THE FUEL FLOW HIGH COMPARED TO OTHER ENGINES?
NO
NO
YES
6
REPLACE THE FUEL CONTROL
ENGINES WITH START BLEED SYSTEM (POST-SB 5425)
ENGINES WITHOUT START BLEED SYSTEM
GO ON TO STEP 7
GO ON TO STEP 13
L-H1625 (0794)

Hot Start Troubleshooting
Figure 121 (Sheet 1)
(Task 72-00-00-810-006)

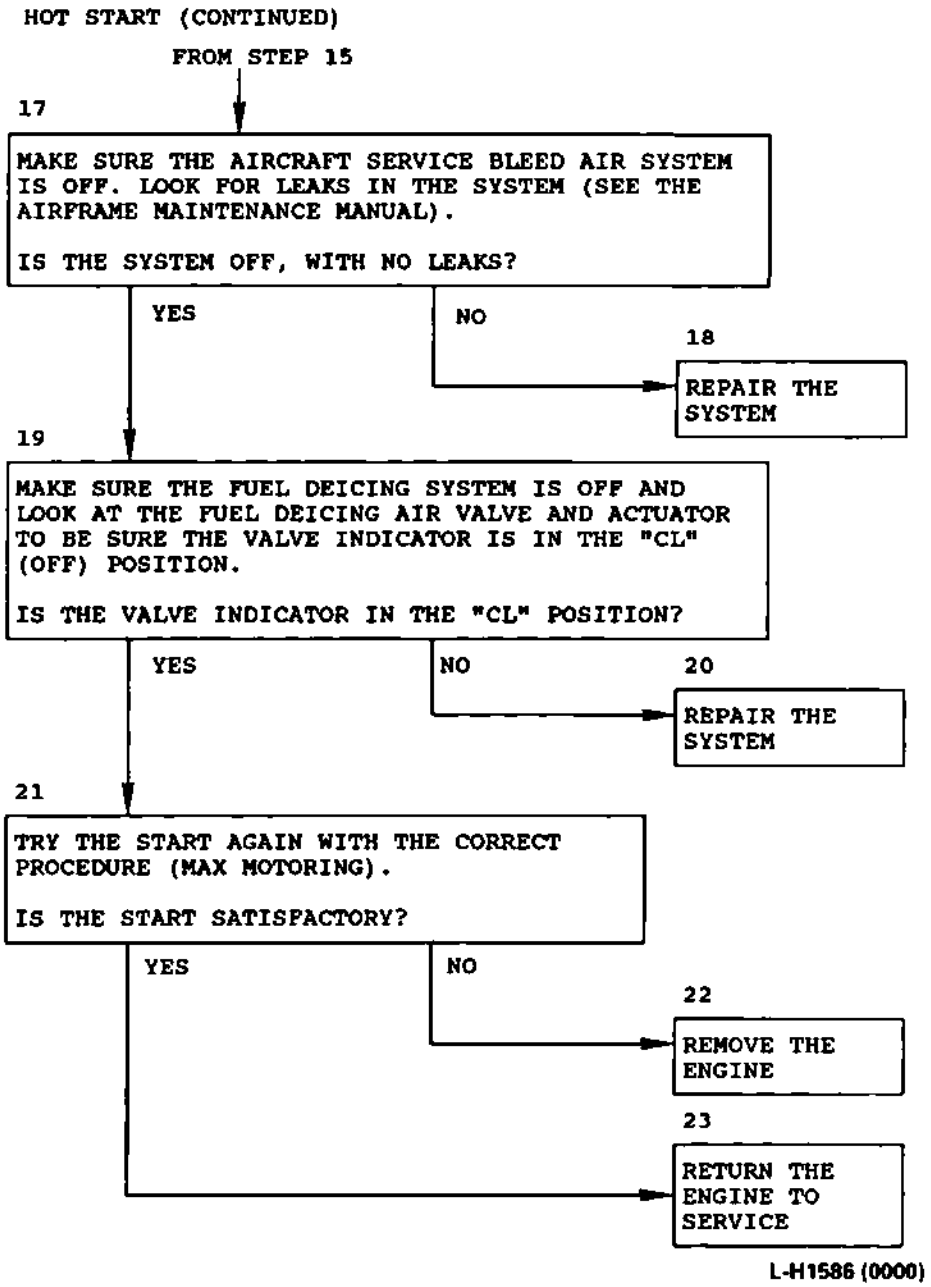

HOT START (CONTINUED)
FROM STEP 5
7
DO A CHECK OF THE 13TH STAGE START BLEED VALVE FOR CORRECT OPERATION AS FOLLOWS:
NOTE: AN ENGINE WITH A START BLEED SYSTEM WILL HAVE A START BLEED CONTROL VALVE FORWARD AND ABOVE THE PRBC. SEE FIGURE 117.
- DISCONNECT THE UPPER PS4 SUPPLY TUBE FROM THE START BLEED CONTROL VALVE.
- PUT MOUTH PRESSURE (SUCTION AND PRESSURE) SLOWLY INTO THE TUBE (OR THE FITTING ON THE DIFFUSER OUTER FAN DUCT) TO MAKE THE START BLEED VALVE OPEN AND CLOSE.
- LISTEN FOR THE NOISE OF THE VALVE (USE A STETHOSCOPE IF NECESSARY).
DOES THE VALVE OPEN AND CLOSE?
YES
NO
8
LUBRICATE THE BLEED VALVES. SEE 75-30-00, PERIODIC INSPECTION CHARTS.
9
EXAMINE THE INLET AND EXHAUST AREAS FOR DAMAGE (USE A STRONG LIGHT). SEE FIGURES 106 AND 107.
IS THERE DAMAGE?
NO
YES
10
EXAMINE THE DAMAGE AND REPAIR AS NECESSARY
GO ON TO STEP 11

L-H1626 (0102)

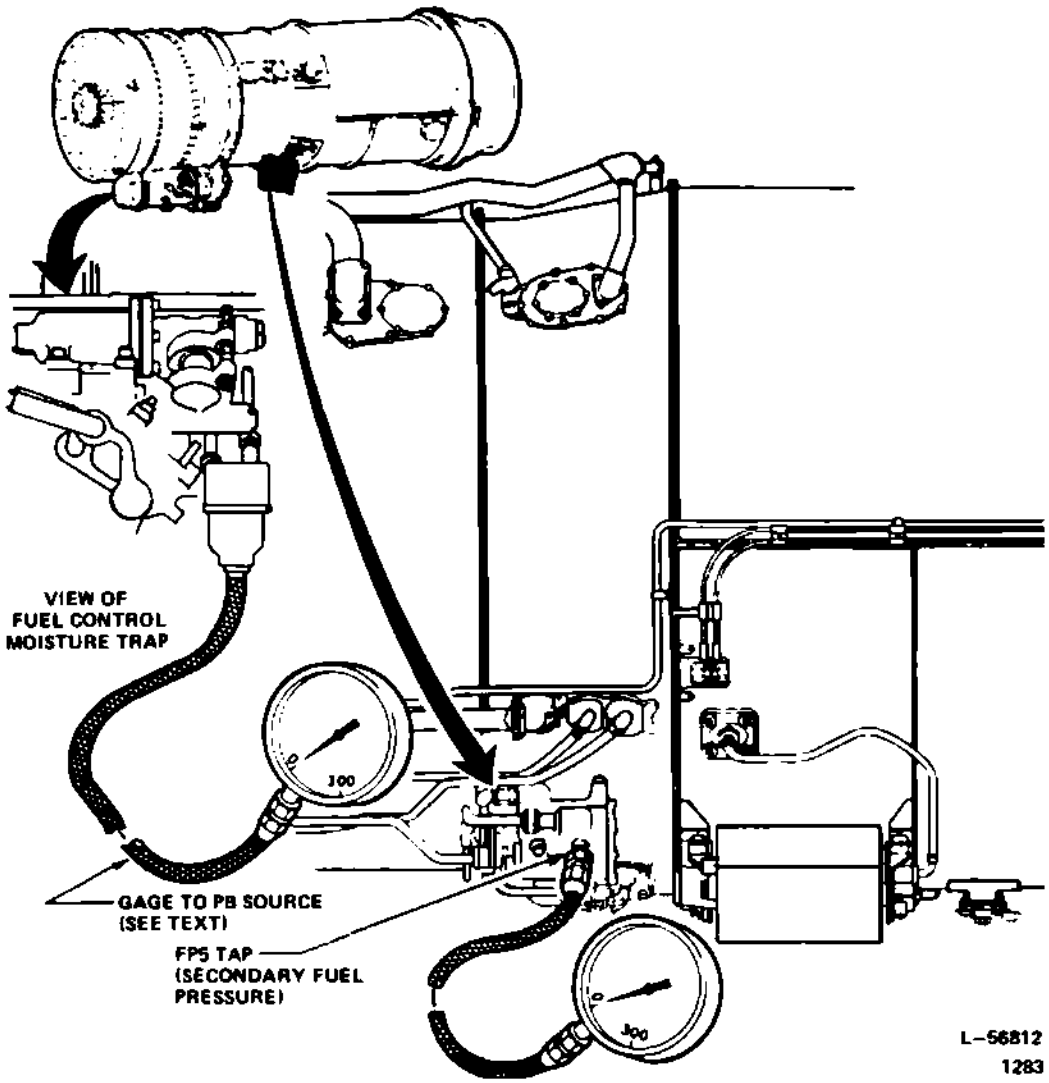
Hot Start Troubleshooting
Figure 121 (Sheet 2)
(Task 72-00-00-810-006)


HOT START (CONTINUED)
FROM STEP 9
11
DO THE CHECK THAT FOLLOWS TO SEE IF THE P&D VALVE SECONDARY PORT IS OPEN:
- CONNECT 0 - 300 PSIG (0 - 2069.7 kPa) GAGES TO THE P&D VALVE FP5 PORT AND TO THE PS4 FITTING ON THE DIFFUSER OUTER FAN DUCT (THE FUEL CONTROL MOISTURE TRAP DRAIN FITTING IS A GOOD ALTERNATE FOR PS4 PRESSURE. SEE FIGURE 122).
- TRY TO START THE ENGINE, AND MONITOR THE GAGE READINGS (THE PS4 READING MUST BE HIGHER THAN THE FP5).
IS PS4 HIGHER THAN FP5?
YES
NO
12
REPLACE THE P&D VALVE (SEE CH/SEC 73-12-01, REM/INST-01)
FROM STEP 5
13
DO BORESCOPE INSPECTIONS OF THE GAS PATH (SEE INSPECTION/CHECK).
IS THERE GAS PATH DAMAGE?
NO
YES
14
REPAIR OR REPLACE THE ENGINE AS NECESSARY
15
MAKE SURE THE INLET ANTI-ICING AIR SYSTEM OPERATES CORRECTLY (WHEN THE SWITCH IS OFF, LOOK AT THE POSITION INDICATOR ON THE VALVE TO BE SURE IT IS IN THE "CL" (OFF) POSITION. LOOK FOR AIR LEAKS.
IS THE INLET ANTI-ICING SYSTEM OK?
16
YES
NO
GO ON TO STEP 17
REPAIR THE SYSTEM
L-H1627 (0102)

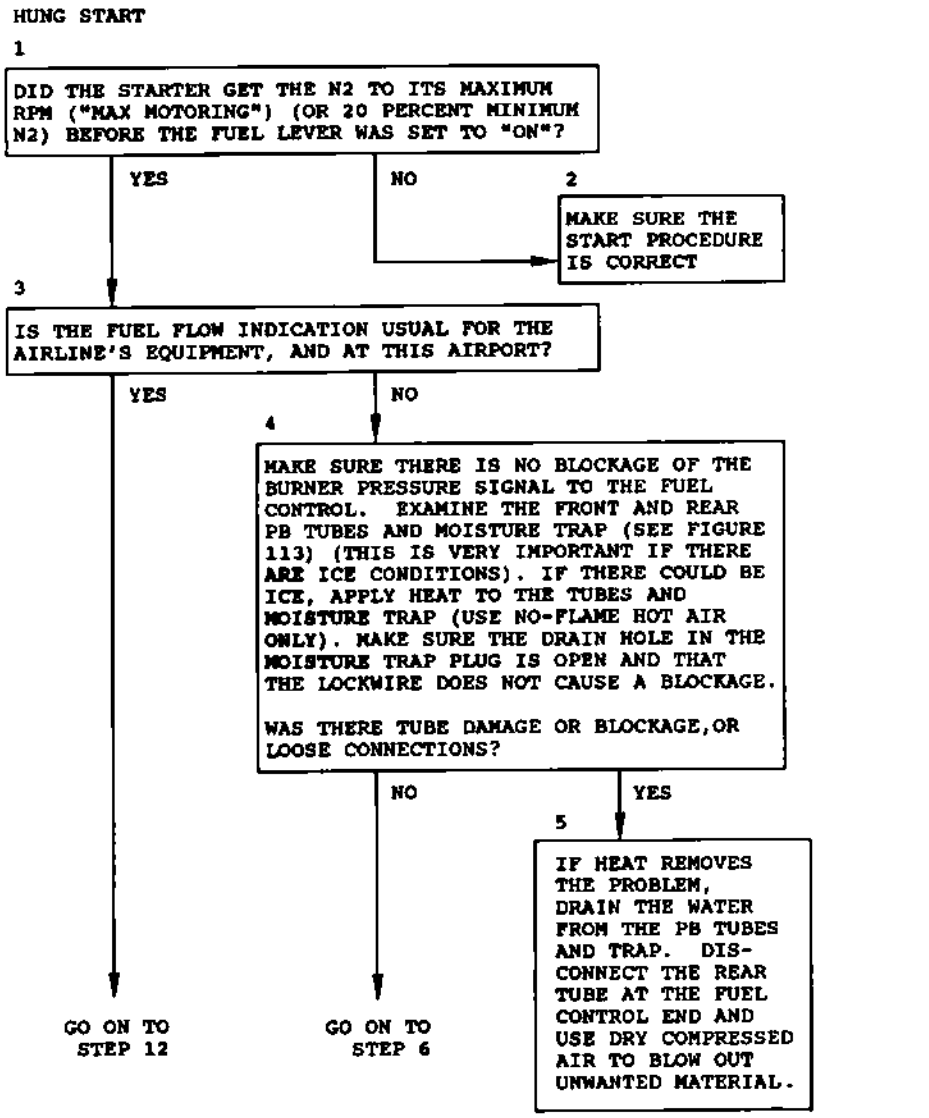
Hot Start Troubleshooting
Figure 121 (Sheet 3)
(Task 72-00-00-810-006)


HOT START (CONTINUED)
FROM STEP 15
17
MAKE SURE THE AIRCRAFT SERVICE BLEED AIR SYSTEM IS OFF. LOOK FOR LEAKS IN THE SYSTEM (SEE THE AIRFRAME MAINTENANCE MANUAL).
IS THE SYSTEM OFF, WITH NO LEAKS?
YES
NO
18
REPAIR THE SYSTEM
19
MAKE SURE THE FUEL DEICING SYSTEM IS OFF AND LOOK AT THE FUEL DEICING AIR VALVE AND ACTUATOR TO BE SURE THE VALVE INDICATOR IS IN THE "CL" (OFF) POSITION.
IS THE VALVE INDICATOR IN THE "CL" POSITION?
YES
NO
20
REPAIR THE SYSTEM
21
TRY THE START AGAIN WITH THE CORRECT PROCEDURE (MAX MOTORING).
IS THE START SATISPACTORY?
YES
NO
22
REMOVE THE ENGINE
23
RETURN THE ENGINE TO SERVICE
L-H1586 (0000)

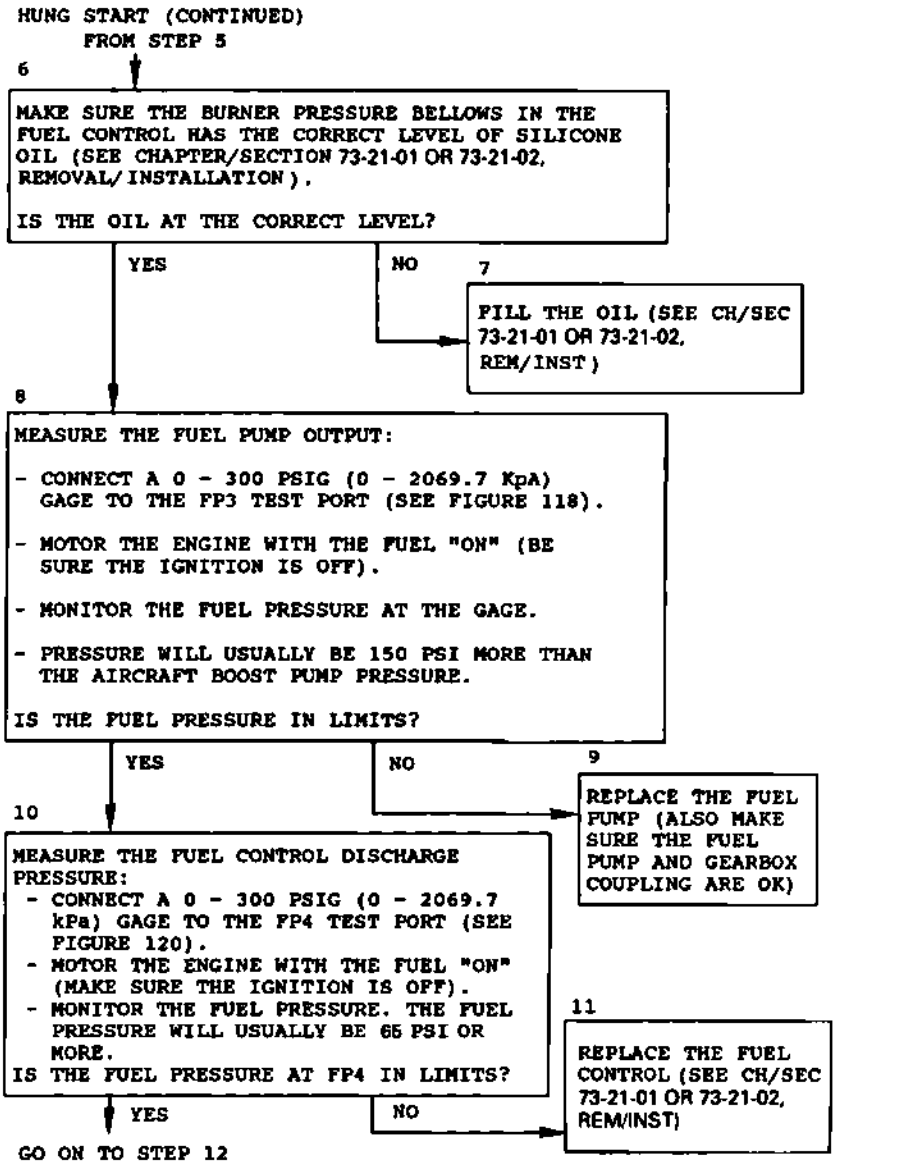
Hot Start Troubleshooting
Figure 121 (Sheet 4)
(Task 72-00-00-810-006)



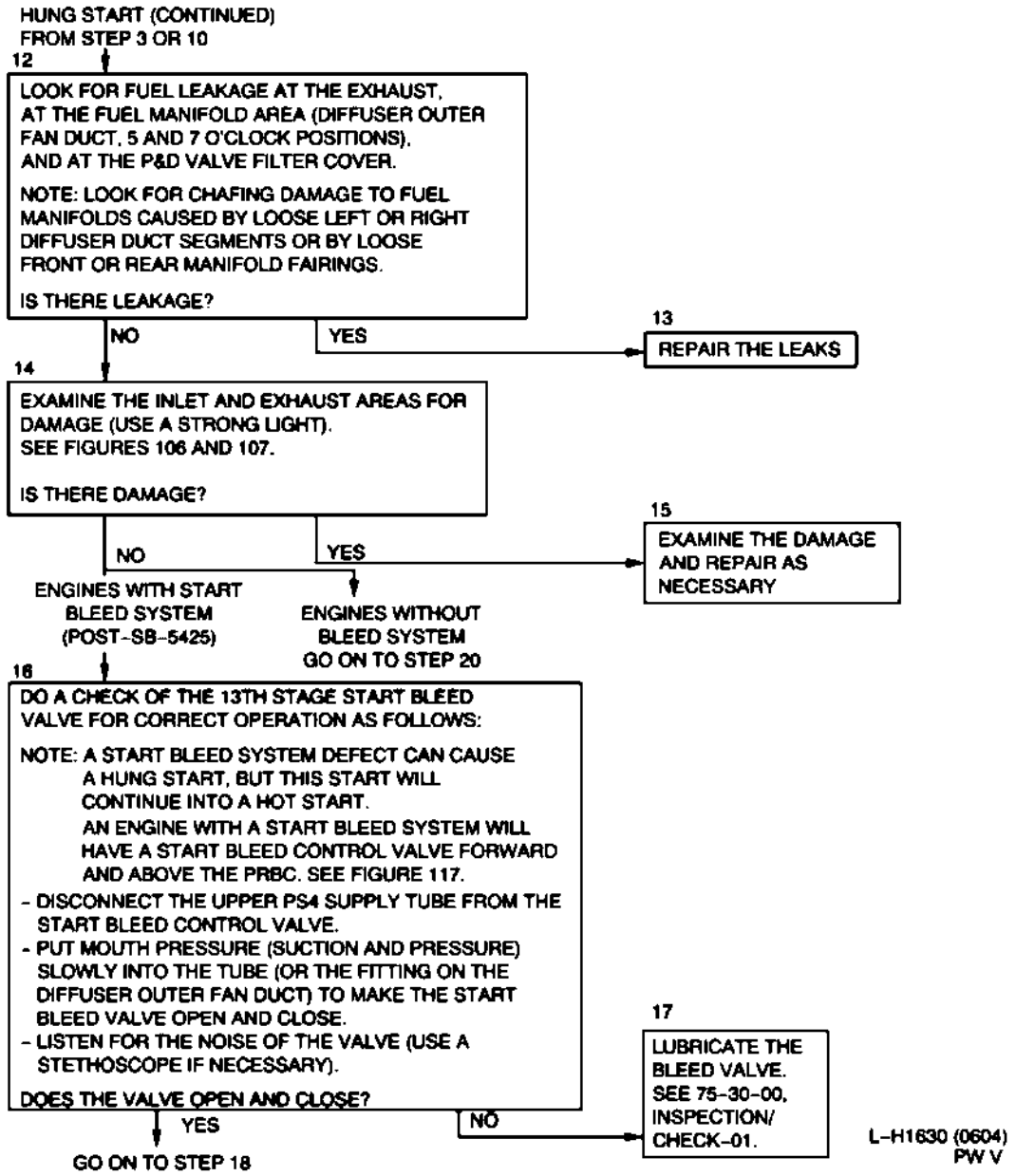
Fuel Pressurizing
And Dump Valve Check
Figure 122
(Task 72-00-00-810-006)


HUNG START
1
DID THE STARTER GET THE N2 TO ITS MAXIMUM RPM ("MAX MOTORING") (OR 20 PERCENT MINIMUM N2) BEFORE THE FUEL LEVER WAS SET TO "ON"?
YES
NO
2
MAKE SURE THE START PROCEDURE IS CORRECT
3
IS THE FUEL FLOW INDICATION USUAL FOR THE AIRLINE'S EQUIPMENT, AND AT THIS AIRPORT?
YES
NO
4
MAKE SURE THERE IS NO BLOCKAGE OF THE BURNER PRESSURE SIGNAL TO THE FUEL CONTROL. EXAMINE THE FRONT AND REAR PB TUBES AND MOISTURE TRAP (SEE FIGURE 113) (THIS IS VERY IMPORTANT IF THERE ARE ICE CONDITIONS). IF THERE COULD BE ICE, APPLY HEAT TO THE TUBES AND MOISTURE TRAP (USE NO-FLAME HOT AIR ONLY). MAKE SURE THE DRAIN HOLE IN THE MOISTURE TRAP PLUG IS OPEN AND THAT THE LOCKWIRE DOES NOT CAUSE A BLOCKAGE.
WAS THERE TUBE DAMAGE OR BLOCKAGE,OR LOOSE CONNECTIONS?
NO
YES
5
IF HEAT REMOVES THE PROBLEM, DRAIN THE WATER FROM THE PB TUBES AND TRAP. DISCONNECT THE REAR TUBE AT THE FUEL CONTROL END AND USE DRY COMPRESSED AIR TO BLOW OUT UNWANTED MATERIAL.
GO ON TO STEP 12
GO ON TO STEP 6
L-H1628 (0701)

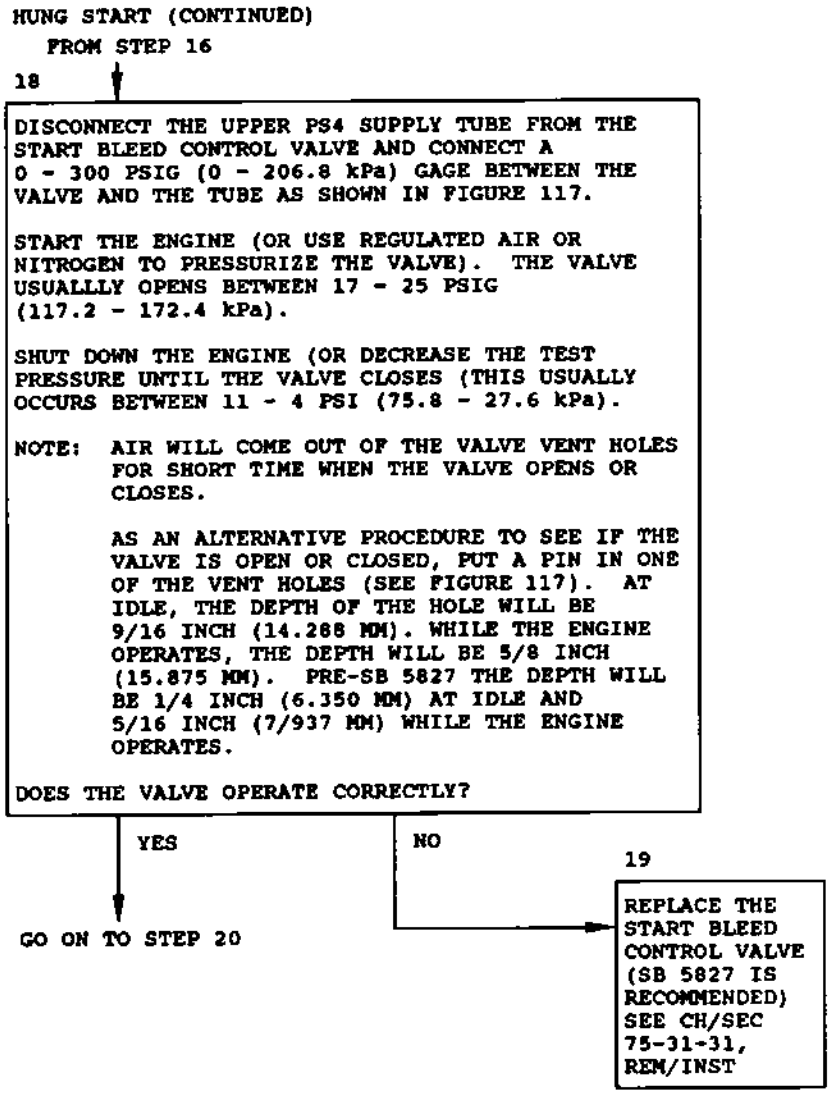
Hung Start Troubleshooting
Figure 123 (Sheet 1)
(Task 72-00-00-810-006)


HUNG START (CONTINUED)
FROM STEP 5
6
MAKE SURE THE BURNER PRESSURE BELLOWS IN THE FUEL CONTROL HAS THE CORRECT LEVEL OF SILICONE OIL (SEE CHAPTER/SECTION 73-21-01 OR 73-21-02, REMOVAL/ INSTALLATION).
IS THE OIL AT THE CORRECT LEVEL?
YES
NO
7
FILL THE OIL (SEE CH/SEC 73-21-01 OR 73-21-02, REM/INST)
8
MEASURE THE FUEL PUMP OUTPUT:
- CONNECT A 0 - 300 PSIG (0 - 2069.7 KpA) GAGE TO THE FP3 TEST PORT (SEE FIGURE 118).
- MOTOR THE ENGINE WITH THE FUEL "ON" (BE SURE THE IGNITION IS OFF).
- MONITOR THE FUEL PRESSURE AT THE GAGE.
- PRESSURE WILL USUALLY BE 150 PSI MORE THAN THE AIRCRAFT BOOST PUMP PRESSURE.
IS THE FUEL PRESSURE IN LIMITS?
YES
NO
9
REPLACE THE FUEL PUMP (ALSO MAKE SURE THE FUEL PUMP AND GEARBOX COUPLING ARE OK)
10
MEASURE THE FUEL CONTROL DISCHARGE PRESSURE:
- CONNECT A 0 - 300 PSIG (0 - 2069.7 kPa) GAGE TO THE FP4 TEST PORT (SEE FIGURE 120).
- MOTOR THE ENGINE WITH THE FUEL "ON" (MAKE SURE THE IGNITION IS OFF).
- MONITOR THE FUEL PRESSURE. THE FUEL PRESSURE WILL USUALLY BE 65 PSI OR MORE.
IS THE FUEL PRESSURE AT FP4 IN LIMITS?
YES
NO
11
REPLACE THE FUEL CONTROL (SEE CH/SEC 73-21-01 OR 73-21-02, REM/INST)
GO ON TO STEP 12
L-H1629 (0102)

Hung Start Troubleshooting
Figure 123 (Sheet 2)
(Task 72-00-00-810-006)

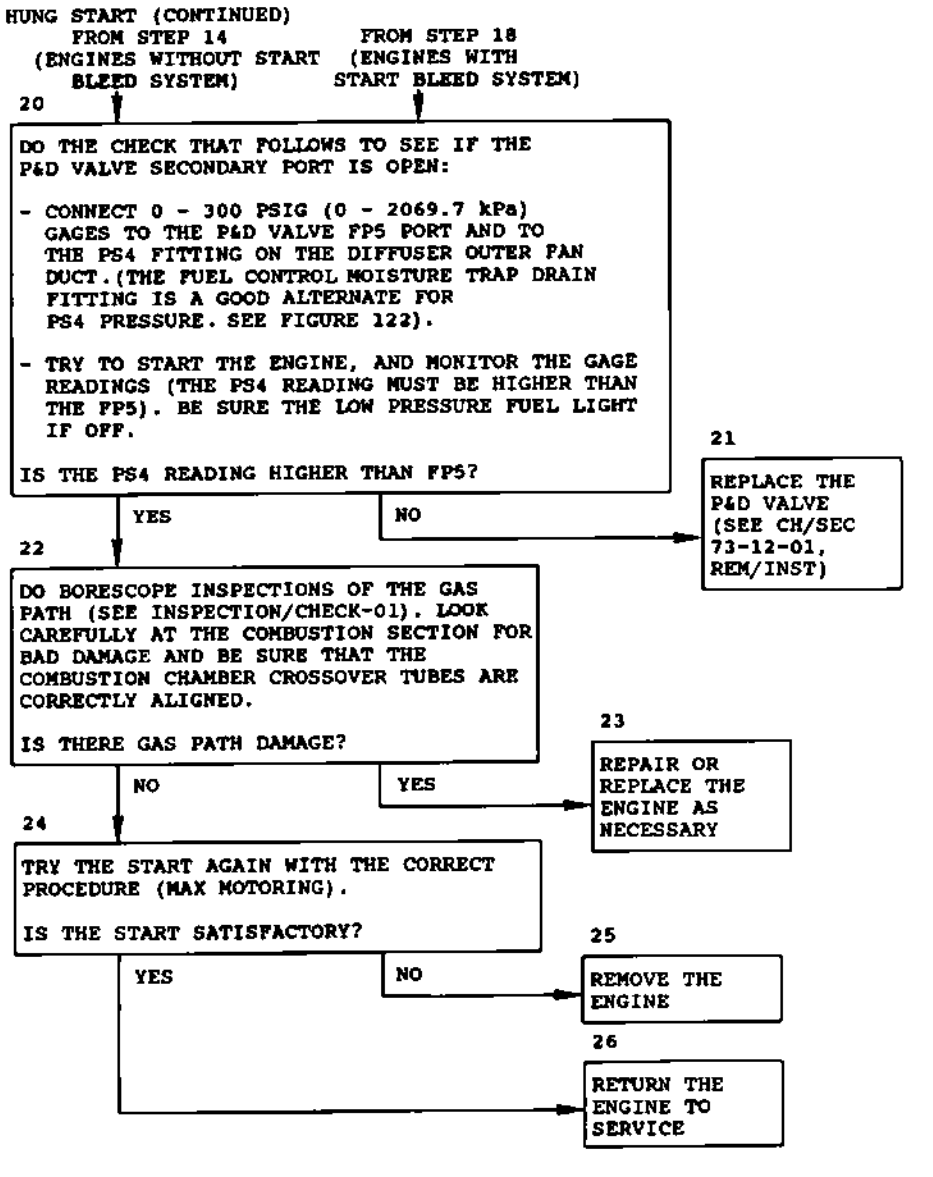

HUNG START (CONTINUED)
FROM STEP 3 OR 10
12
LOOK FOR FUEL LEAKAGE AT THE EXHAUST, AT THE FUEL MANIFOLD AREA (DIFFUSER OUTER FAN DUCT, 5 AND 7 O'CLOCK POSITIONS), AND AT THE P&D VALVE FILTER COVER.
NOTE: LOOK FOR CHAFING DAMAGE TO FUEL MANIFOLDS CAUSED BY LOOSE LEFT OR RIGHT DIFFUSER DUCT SEGMENTS OR BY LOOSE FRONT OR REAR MANIFOLD FAIRINGS.
IS THERE LEAKAGE?
NO
YES
13
REPAIR THE LEAKS
14
EXAMINE THE INLET AND EXHAUST AREAS FOR DAMAGE (USE A STRONG LIGHT). SEE FIGURES 106 AND 107.
IS THERE DAMAGE?
NO
YES
15
EXAMINE THE DAMAGE AND REPAIR AS NECESSARY
ENGINES WITH START BLEED SYSTEM (POST-SB-5425)
ENGINES WITHOUT BLEED SYSTEM GO ON TO STEP 20
16
DO A CHECK OF THE 13TH STAGE START BLEED VALVE FOR CORRECT OPERATION AS FOLLOWS:
NOTE: A START BLEED SYSTEM DEFECT CAN CAUSE A HUNG START, BUT THIS START WILL CONTINUE INTO A HOT START.
AN ENGINE WITH A START BLEED SYSTEM WILL HAVE A START BLEED CONTROL VALVE FORWARD AND ABOVE THE PRBC. SEE FIGURE 117.
- DISCONNECT THE UPPER PS4 SUPPLY TUBE FROM THE START BLEED CONTROL VALVE.
- PUT MOUTH PRESSURE (SUCTION AND PRESSURE) SLOWLY INTO THE TUBE (OR THE FITTING ON THE DIFFUSER OUTER FAN DUCT) TO MAKE THE START BLEED VALVE OPEN AND CLOSE.
- LISTEN FOR THE NOISE OF THE VALVE (USE A STETHOSCOPE IF NECESSARY).
DOES THE VALVE OPEN AND CLOSE?
YES
GO ON TO STEP 18
NO
17
LUBRICATE THE BLEED VALVE. SEE 75-30-00, INSPECTION/ CHECK-01.
L-H1630 (0604)
PW V

Hung Start Troubleshooting
Figure 123 (Sheet 3)
(Task 72-00-00-810-006)


HUNG START (CONTINUED)
FROM STEP 16
18
DISCONNECT THE UPPER PS4 SUPPLY TUBE FROM THE START BLEED CONTROL VALVE AND CONNECT A 0 - 300 PSIG (0 - 206.8 kPa) GAGE BETWEEN THE VALVE AND THE TUBE AS SHOWN IN FIGURE 117.
START THE ENGINE (OR USE REGULATED AIR OR NITROGEN TO PRESSURIZE THE VALVE). THE VALVE USUALLLY OPENS BETWEEN 17 - 25 PSIG (117.2 - 172.4 kPa).
SHUT DOWN THE ENGINE (OR DECREASE THE TEST PRESSURE UNTIL THE VALVE CLOSES (THIS USUALLY OCCURS BETWEEN 11 - 4 PSI (75.8 - 27.6 kPa).
NOTE: AIR WILL COME OUT OF THE VALVE VENT HOLES FOR SHORT TIME WHEN THE VALVE OPENS OR CLOSES.
AS AN ALTERNATIVE PROCEDURE TO SEE IF THE VALVE IS OPEN OR CLOSED, PUT A PIN IN ONE OF THE VENT HOLES (SEE FIGURE 117). AT IDLE, THE DEPTH OF THE HOLE WILL BE 9/16 INCH (14.288 MM). WHILE THE ENGINE OPERATES, THE DEPTH WILL BE 5/8 INCH (15.875 MM). PRE-SB 5827 THE DEPTH WILL BE 1/4 INCH (6.350 MM) AT IDLE AND 5/16 INCH (7/937 MM) WHILE THE ENGINE OPERATES.
DOES THE VALVE OPERATE CORRECTLY?
YES
GO ON TO STEP 20
NO
19
REPLACE THE START BLEED CONTROL VALVE (SB 5827 IS RECOMMENDED) SEE CH/SEC 75-31-31, REM/INST

L-H1631 (0701)

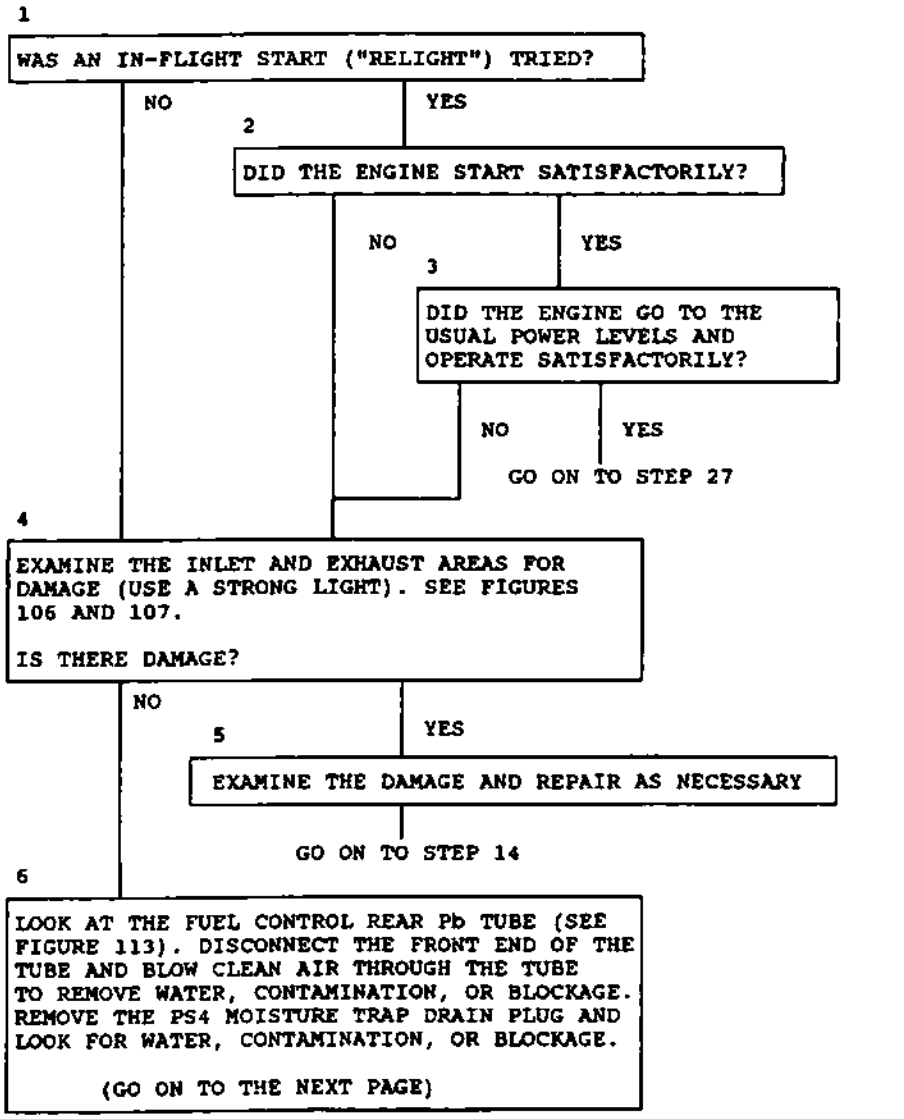
Hung Start Troubleshooting
Figure 123 (Sheet 4)
(Task 72-00-00-810-006)


HUNG START (CONTINUED)
FROM STEP 14
(ENGINES WITHOUT START BLEED SYSTEM)
FROM STEP 18
(ENGINES WITH START BLEED SYSTEM)
20
DO THE CHECK THAT FOLLOWS TO SEE IF THE P&D VALVE SECONDARY PORT IS OPEN:
- CONNECT 0 - 300 PSIG (0 - 2069.7 kPa) GAGES TO THE P&D VALVE FP5 PORT AND TO THE PS4 FITTING ON THE DIFFUSER OUTER FAN DUCT.(THE FUEL CONTROL MOISTURE TRAP DRAIN FITTING IS A GOOD ALTERNATE FOR PS4 PRESSURE. SEE FIGURE 122).
- TRY TO START THE ENGINE, AND MONITOR THE GAGE READINGS (THE PS4 READING MUST BE HIGHER THAN THE FP5). BE SURE THE LOW PRESSURE FUEL LIGHT IF OFF.
IS THE PS4 READING HIGHER THAN FP5?
YES
NO
21
REPLACE THE P&D VALVE (SEE CH/SEC 73-12-01, REM/INST)
22
DO BORESCOPE INSPECTIONS OF THE GAS PATH (SEE INSPECTION/CHECK-01). LOOK CAREFULLY AT THE COMBUSTION SECTION FOR BAD DAMAGE AND BE SURE THAT THE COMBUSTION CHAMBER CROSSOVER TUBES ARE CORRECTLY ALIGNED.
IS THERE GAS PATH DAMAGE?
NO
YES
23
REPAIR OR REPLACE THE ENGINE AS NECESSARY
24
TRY THE START AGAIN WITH THE CORRECT PROCEDURE (MAX MOTORING).
IS THE START SATISFACTORY?
YES
NO
25
REMOVE THE ENGINE
26
RETURN THE ENGINE TO SERVICE

L-H1632 (0102)

Hung Start Troubleshooting
Figure 123 (Sheet 5)
(Task 72-00-00-810-006)

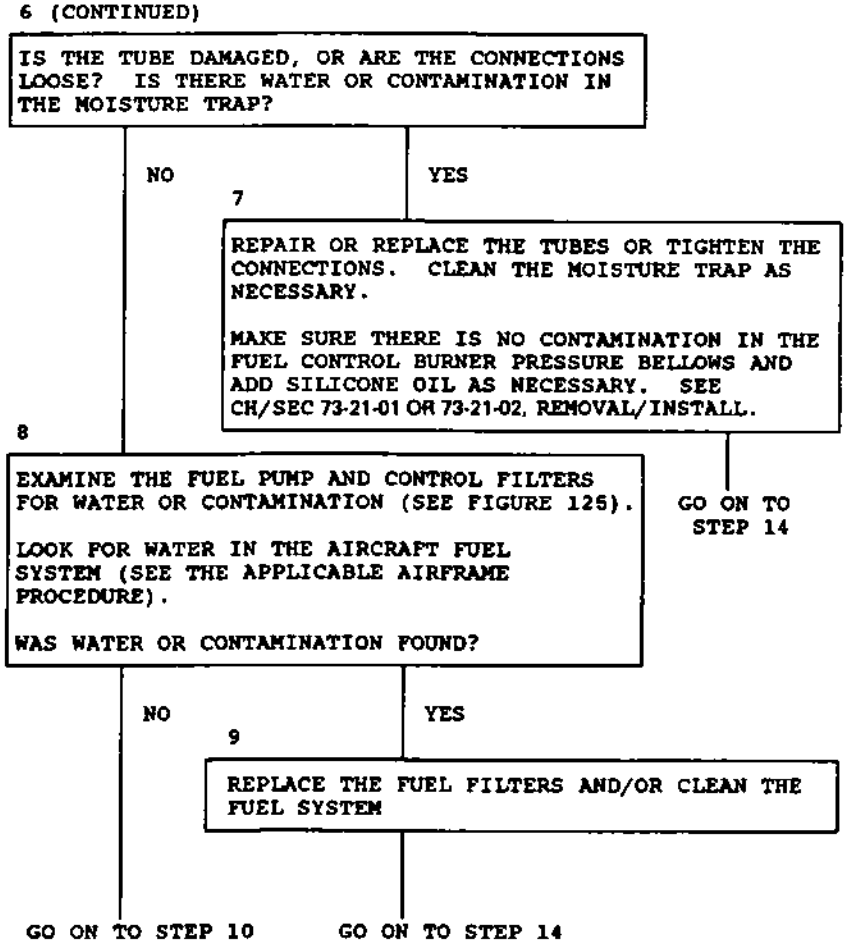
ENGINE FLAMEOUT


1
WAS AN IN-FLIGHT START ("RELIGHT") TRIED?
NO
YES
2
DID THE ENGINE START SATISFACTORILY?
NO
YES
3
DID THE ENGINE GO TO THE USUAL POWER LEVELS AND OPERATE SATISFACTORILY?
NO
YES
GO ON TO STEP 27
4
EXAMINE THE INLET AND EXHAUST AREAS FOR DAMAGE (USE A STRONG LIGHT). SEE FIGURES 106 AND 107.
IS THERE DAMAGE?
NO
YES
5
EXAMINE THE DAMAGE AND REPAIR AS NECESSARY
GO ON TO STEP 14
6
LOOK AT THE FUEL CONTROL REAR Pb TUBE (SEE FIGURE 113). DISCONNECT THE FRONT END OF THE TUBE AND BLOW CLEAN AIR THROUGH THE TUBE TO REMOVE WATER, CONTAMINATION, OR BLOCKAGE. REMOVE THE PS4 MOISTURE TRAP DRAIN PLUG AND LOOK FOR WATER, CONTAMINATION, OR BLOCKAGE.
(GO ON TO THE NEXT PAGE)

L-H1633 (0701)

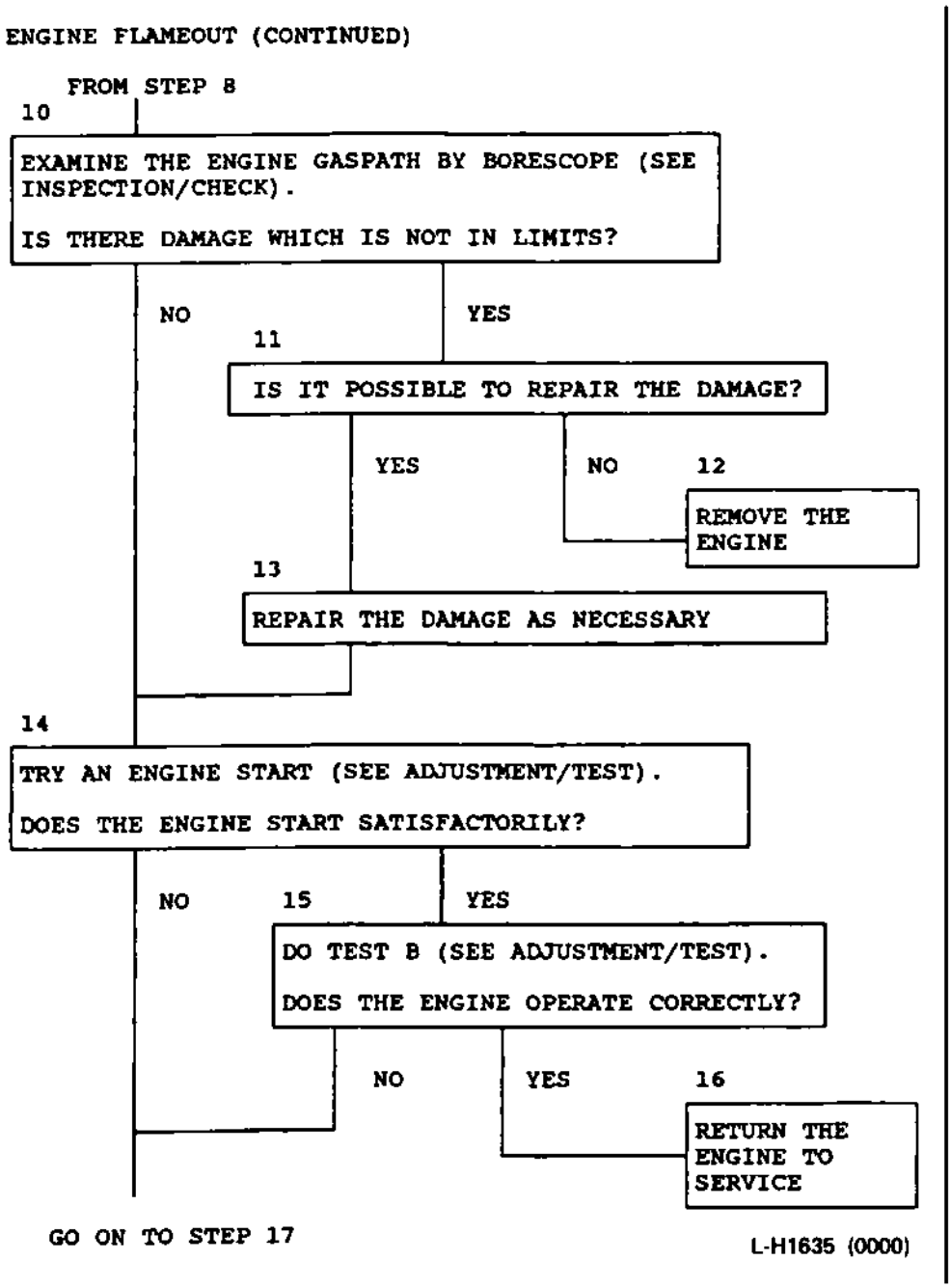
Engine Flameout In
Flight Troubleshooting
Figure 124 (Sheet 1)
(Task 72-00-00-810-006)

ENGINE FLAMEOUT (CONTINUED)


6 (CONTINUED)
IS THE TUBE DAMAGED, OR ARE THE CONNECTIONS LOOSE? IS THERE WATER OR CONTAMINATION IN THE MOISTURE TRAP?
NO
YES
7
REPAIR OR REPLACE THE TUBES OR TIGHTEN THE CONNECTIONS. CLEAN THE MOISTURE TRAP AS NECESSARY.
MAKE SURE THERE IS NO CONTAMINATION IN THE FUEL CONTROL BURNER PRESSURE BELLOWS AND ADD SILICONE OIL AS NECESSARY. SEE CH/SEC 73-21-01 OR 73-21-02, REMOVAL/INSTALL.
8
EXAMINE THE FUEL PUMP AND CONTROL FILTERS FOR WATER OR CONTAMINATION (SEE FIGURE 125).
LOOK FOR WATER IN THE AIRCRAFT FUEL SYSTEM (SEE THE APPLICABLE AIRFRAME PROCEDURE).
WAS WATER OR CONTAMINATION FOUND?
GO ON TO STEP 14
NO
YES
9
REPLACE THE FUEL FILTERS AND/OR CLEAN THE FUEL SYSTEM
GO ON TO STEP 10
GO ON TO STEP 14

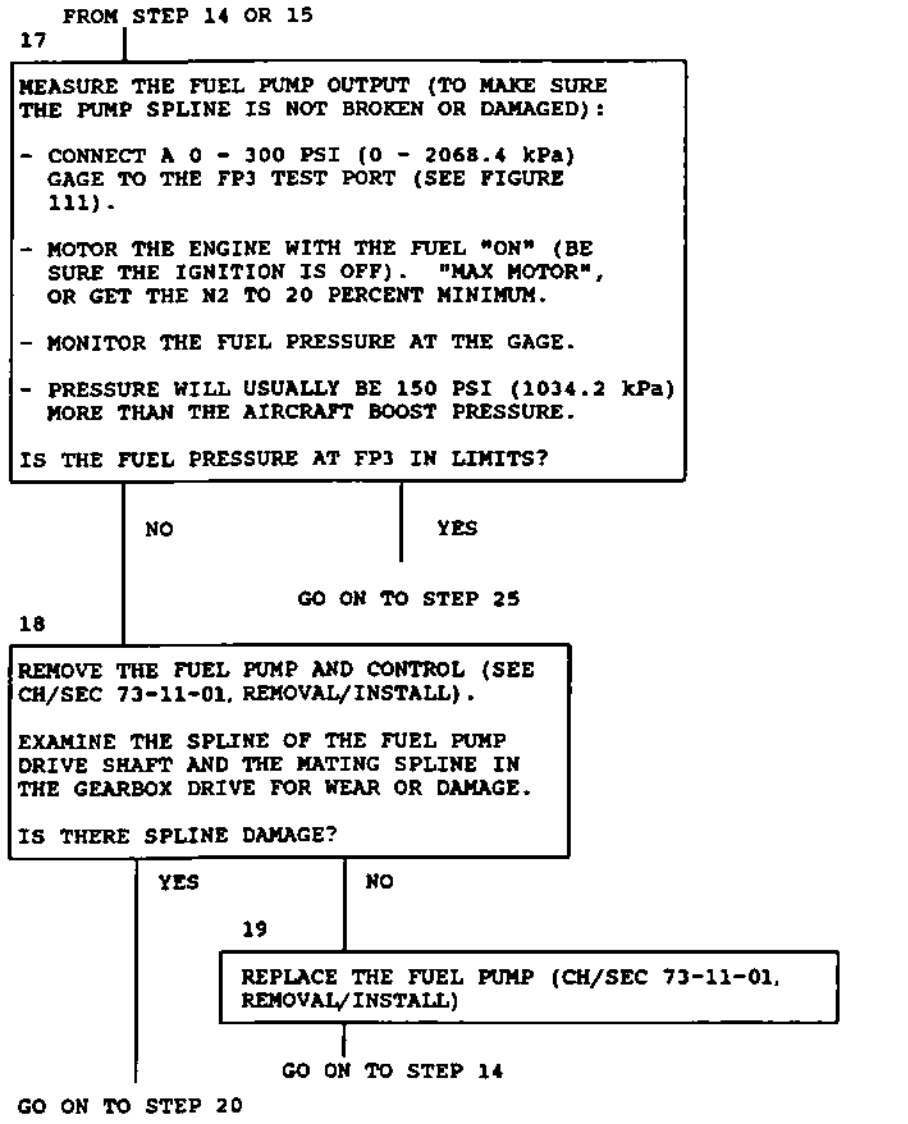
L-H1634 (0102)

Engine Flameout In
Flight Troubleshooting
Figure 124 (Sheet 2)
(Task 72-00-00-810-006)



Engine Flameout In
Flight Troubleshooting
Figure 124 (Sheet 3)
(Task 72-00-00-810-006)

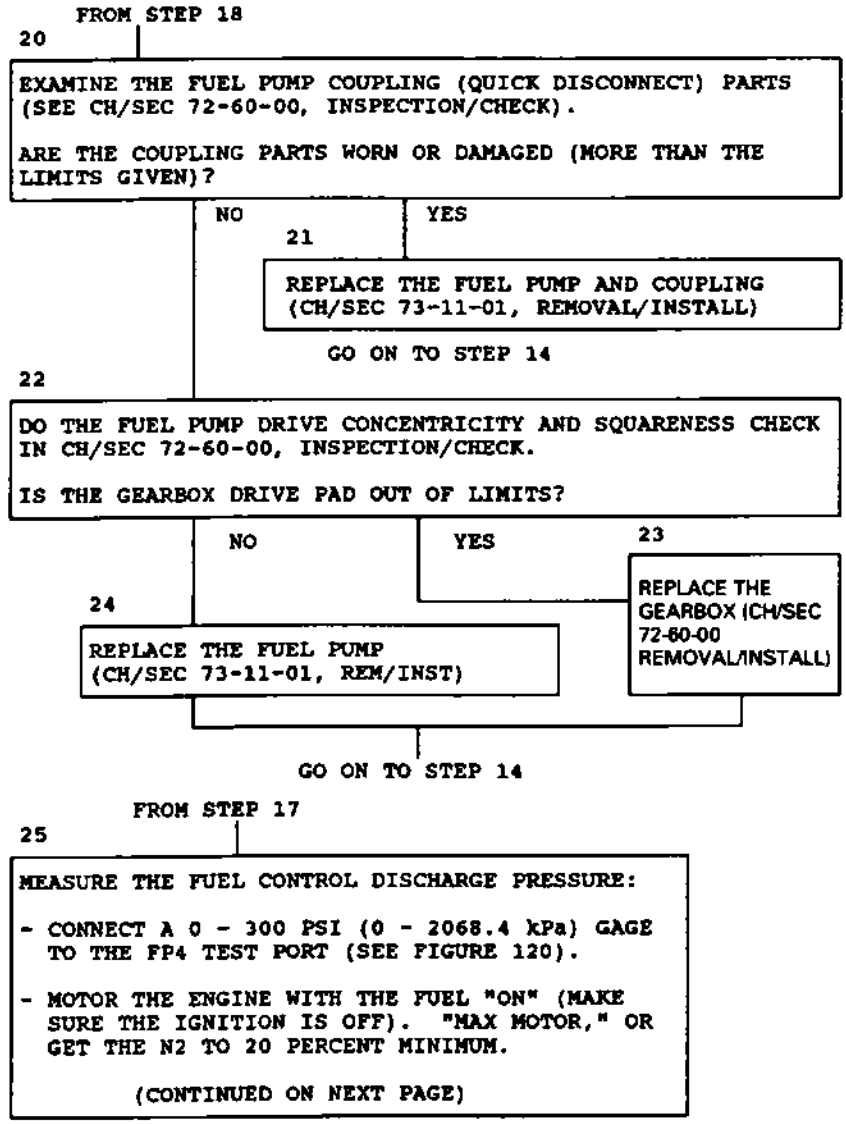
ENGINE FLAMEOUT (CONTINUED)


FROM STEP 14 OR 15
17
MEASURE THE FUEL PUMP OUTPUT (TO MAKE SURE THE PUMP SPLINE IS NOT BROKEN OR DAMAGED):
- CONNECT A 0 - 300 PSI (0 - 2068.4 kPa) GAGE TO THE FP3 TEST PORT (SEE FIGURE 111).
- MOTOR THE ENGINE WITH THE FUEL "ON" (BE SURE THE IGNITION IS OFF). "MAX MOTOR", OR GET THE N2 TO 20 PERCENT MINIMUM.
- MONITOR THE FUEL PRESSURE AT THE GAGE.
- PRESSURE WILL USUALLY BE 150 PSI (1034.2 kPa) MORE THAN THE AIRCRAFT BOOST PRESSURE.
IS THE FUEL PRESSURE AT FP3 IN LIMITS?
NO
YES
GO ON TO STEP 25
18
REMOVE THE FUEL PUMP AND CONTROL (SEE CH/SEC 73-11-01, REMOVAL/INSTALL).
EXAMINE THE SPLINE OF THE FUEL PUMP DRIVE SHAFT AND THE MATING SPLINE IN THE GEARBOX DRIVE FOR WEAR OR DAMAGE.
IS THERE SPLINE DAMAGE?
YES
NO
19
REPLACE THE FUEL PUMP (CH/SEC 73-11-01, REMOVAL/INSTALL)
GO ON TO STEP 14
GO ON TO STEP 20

L-H1636 (0102)

Engine Flameout In
Flight Troubleshooting
Figure 124 (Sheet 4)
(Task 72-00-00-810-006)

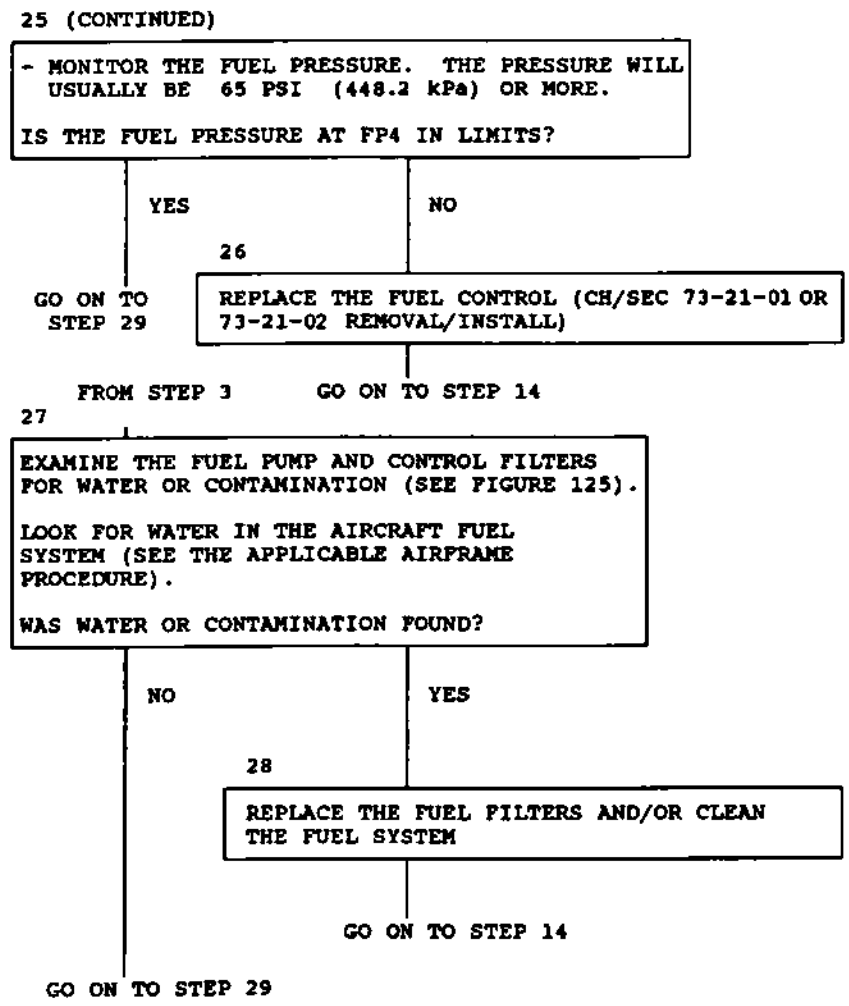
ENGINE FLAMEOUT (CONTINUED)


FROM STEP 18
20
EXAMINE THE FUEL PUMP COUPLING (QUICK DISCONNECT) PARTS (SEE CH/SEC 72-60-00, INSPECTION/CHECK).
ARE THE COUPLING PARTS WORN OR DAMAGED (MORE THAN THE LIMITS GIVEN)?
NO
YES
21
REPLACE THE FUEL PUMP AND COUPLING (CH/SEC 73-11-01, REMOVAL/INSTALL)
GO ON TO STEP 14
22
DO THE FUEL PUMP DRIVE CONCENTRICITY AND SQUARENESS CHECK IN CH/SEC 72-60-00, INSPECTION/CHECK.
IS THE GEARBOX DRIVE PAD OUT OF LIMITS?
NO
YES
23
REPLACE THE GEARBOX (CH/SEC 72-60-00 REMOVAL/INSTALL)
24
REPLACE THE FUEL PUMP (CH/SEC 73-11-01, REM/INST)
GO ON TO STEP 14
FROM STEP 17
25
MEASURE THE FUEL CONTROL DISCHARGE PRESSURE:
- CONNECT A 0 - 300 PSI (0 - 2068.4 kPa) GAGE TO THE FP4 TEST PORT (SEE FIGURE 120).
- MOTOR THE ENGINE WITH THE FUEL "ON" (MAKE SURE THE IGNITION IS OFF). "MAX MOTOR," OR GET THE N2 TO 20 PERCENT MINIMUM.
(CONTINUED ON NEXT PAGE)

L-H1637 (0102)

Engine Flameout In Flight Troubleshooting
Figure 124 (Sheet 5)
(Task 72-00-00-810-006)

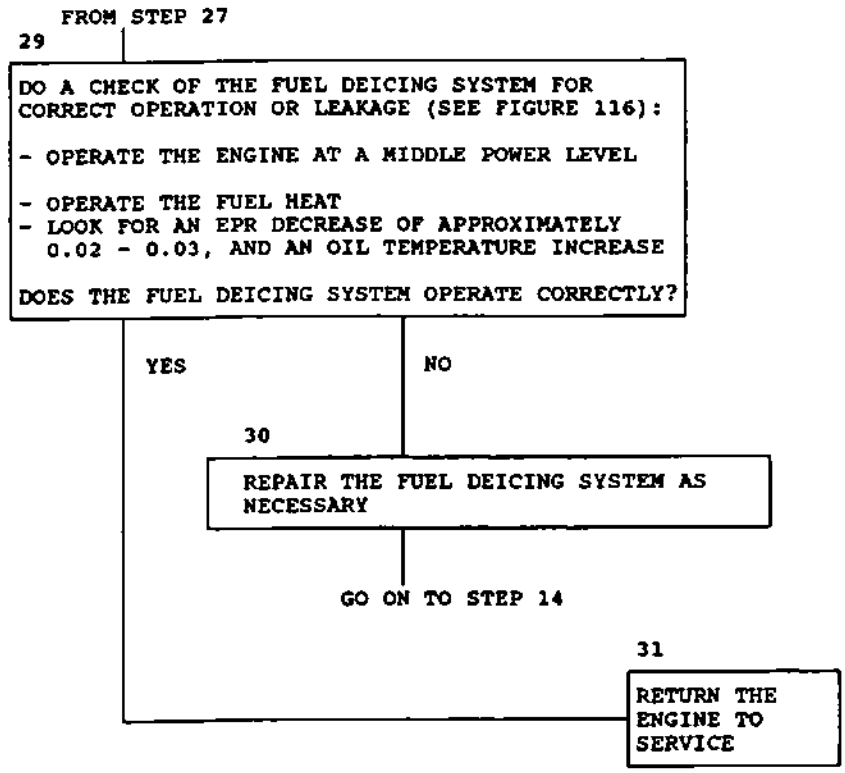
ENGINE FLAMEOUT (CONTINUED)


25 (CONTINUED)
- MONITOR THE FUEL PRESSURE. THE PRESSURE WILL USUALLY BE 65 PSI (448.2 kPa) OR MORE.
IS THE FUEL PRESSURE AT FP4 IN LIMITS?
YES
NO
26
GO ON TO STEP 29
REPLACE THE FUEL CONTROL (CH/SEC 73-21-01 OR 73-21-02 REMOVAL/INSTALL)
FROM STEP 3
GO ON TO STEP 14
27
EXAMINE THE FUEL PUMP AND CONTROL FILTERS FOR WATER OR CONTAMINATION (SEE FIGURE 125).
LOOK FOR WATER IN THE AIRCRAFT FUEL SYSTEM (SEE THE APPLICABLE AIRFRAME PROCEDURE).
WAS WATER OR CONTAMINATION FOUND?
NO
YES
28
REPLACE THE FUEL FILTERS AND/OR CLEAN THE FUEL SYSTEM
GO ON TO STEP 14
GO ON TO STEP 29

L-H1638 (0102)

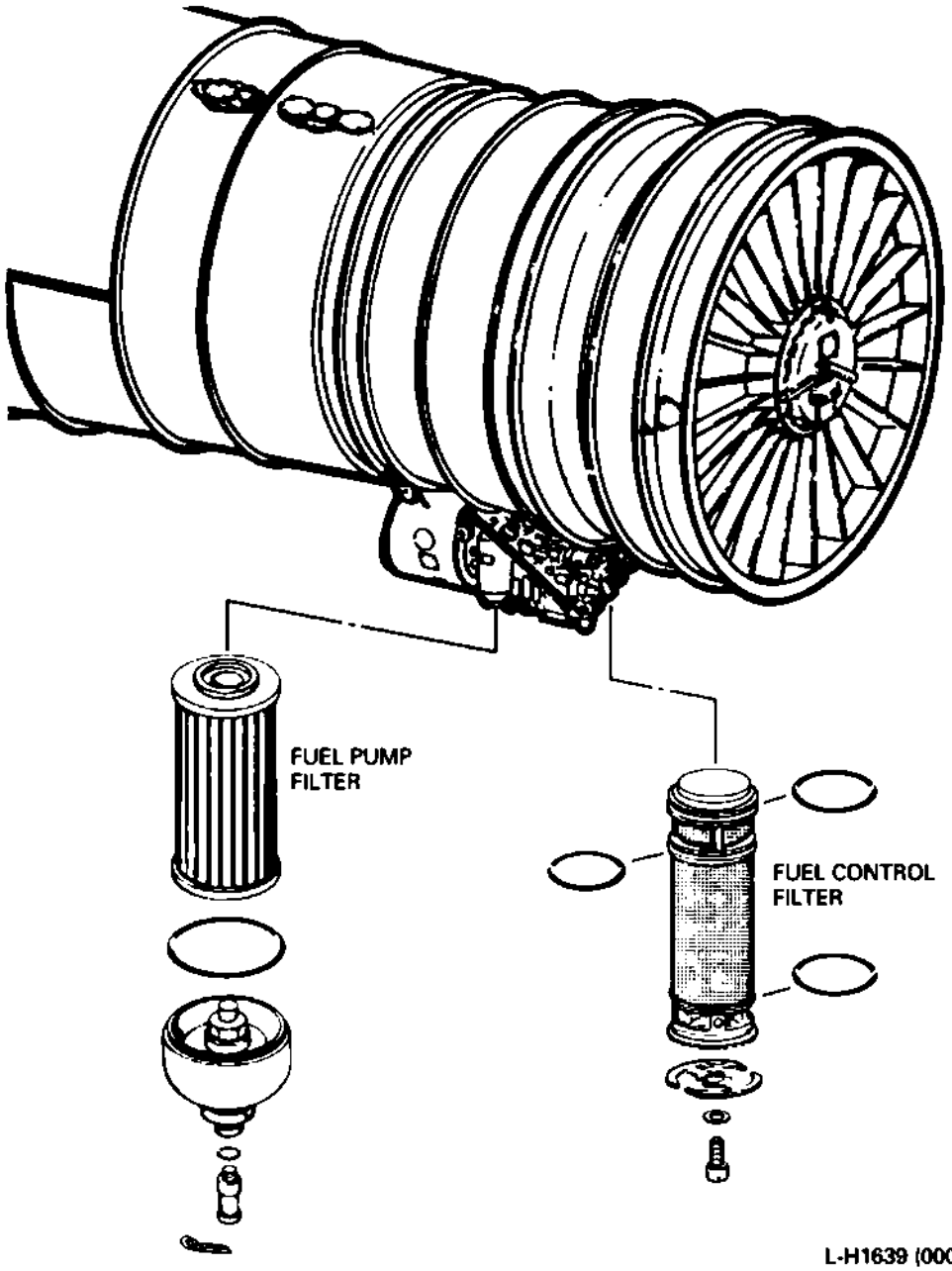
Engine Flameout In
Flight Troubleshooting
Figure 124 (Sheet 6)
(Task 72-00-00-810-006)

ENGINE FLAMEOUT (CONTINUED)

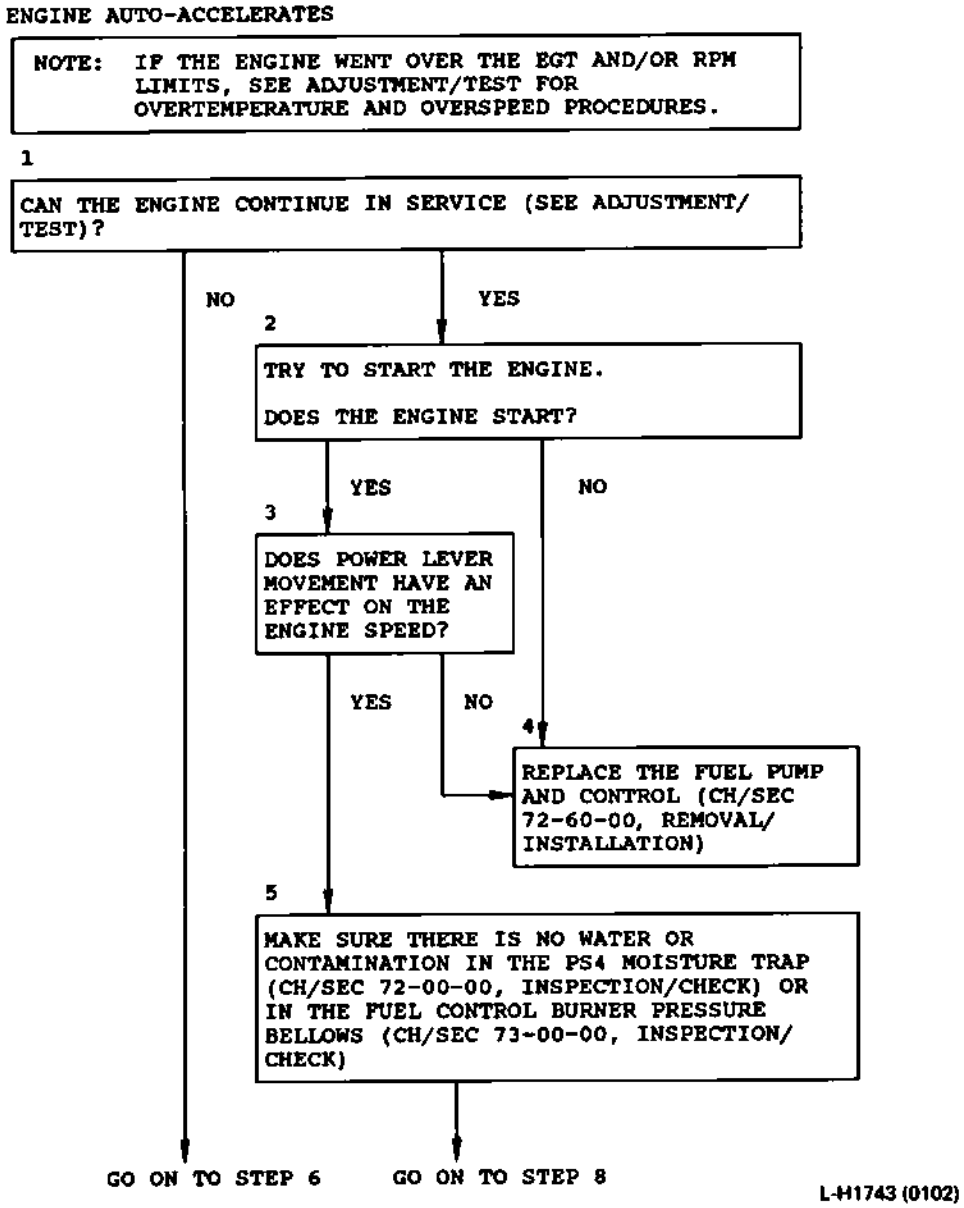

FROM STEP 27
29
DO A CHECK OF THE FUEL DEICING SYSTEM FOR CORRECT OPERATION OR LEAKAGE (SEE FIGURE 116):
- OPERATE THE ENGINE AT A MIDDLE POWER LEVEL
- OPERATE THE FUEL HEAT
- LOOK FOR AN EPR DECREASE OF APPROXIMATELY 0.02 - 0.03, AND AN OIL TEMPERATURE INCREASE
DOES THE FUEL DEICING SYSTEM OPERATE CORRECTLY?
YES
NO
30
REPAIR THE FUEL DEICING SYSTEM AS NECESSARY
GO ON TO STEP 14
31
RETURN THE ENGINE TO SERVICE

L-H1642 (0701)

Engine Flameout In
Flight Troubleshooting
Figure 124 (Sheet 7)
(Task 72-00-00-810-006)

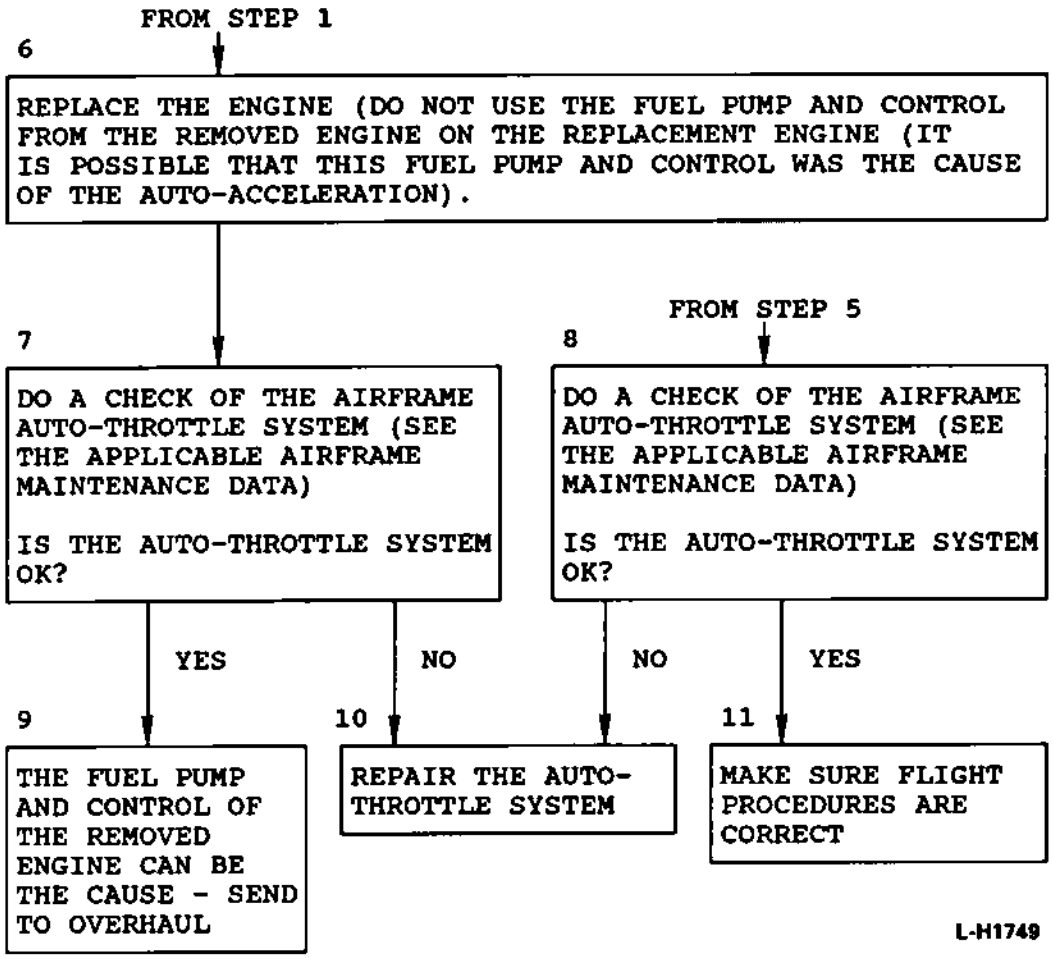


Fuel Filter Inspection
Figure 125
(Task 72-00-00-810-006)


ENGINE AUTO-ACCELERATES
NOTE: IF THE ENGINE WENT OVER THE EGT AND/OR RPM LIMITS, SEE ADJUSTMENT/TEST FOR OVERTEMPERATURE AND OVERSPEED PROCEDURES.
1
CAN THE ENGINE CONTINUE IN SERVICE (SEE ADJUSTMENT/ TEST)?
NO
YES
2
TRY TO START THE ENGINE.
DOES THE ENGINE START?
YES
NO
3
DOES POWER LEVER MOVEMENT HAVE AN EFFECT ON THE ENGINE SPEED?
YES
NO
4
REPLACE THE FUEL PUMP AND CONTROL (CH/SEC 72-60-00, REMOVAL/ INSTALLATION)
5
MAKE SURE THERE IS NO WATER OR CONTAMINATION IN THE PS4 MOISTURE TRAP (CH/SEC 72-00-00, INSPECTION/CHECK) OR IN THE FUEL CONTROL BURNER PRESSURE BELLOWS (CH/SEC 73-00-00, INSPECTION/ CHECK)
GO ON TO STEP 6
GO ON TO STEP 8
L-H1743 (0102)

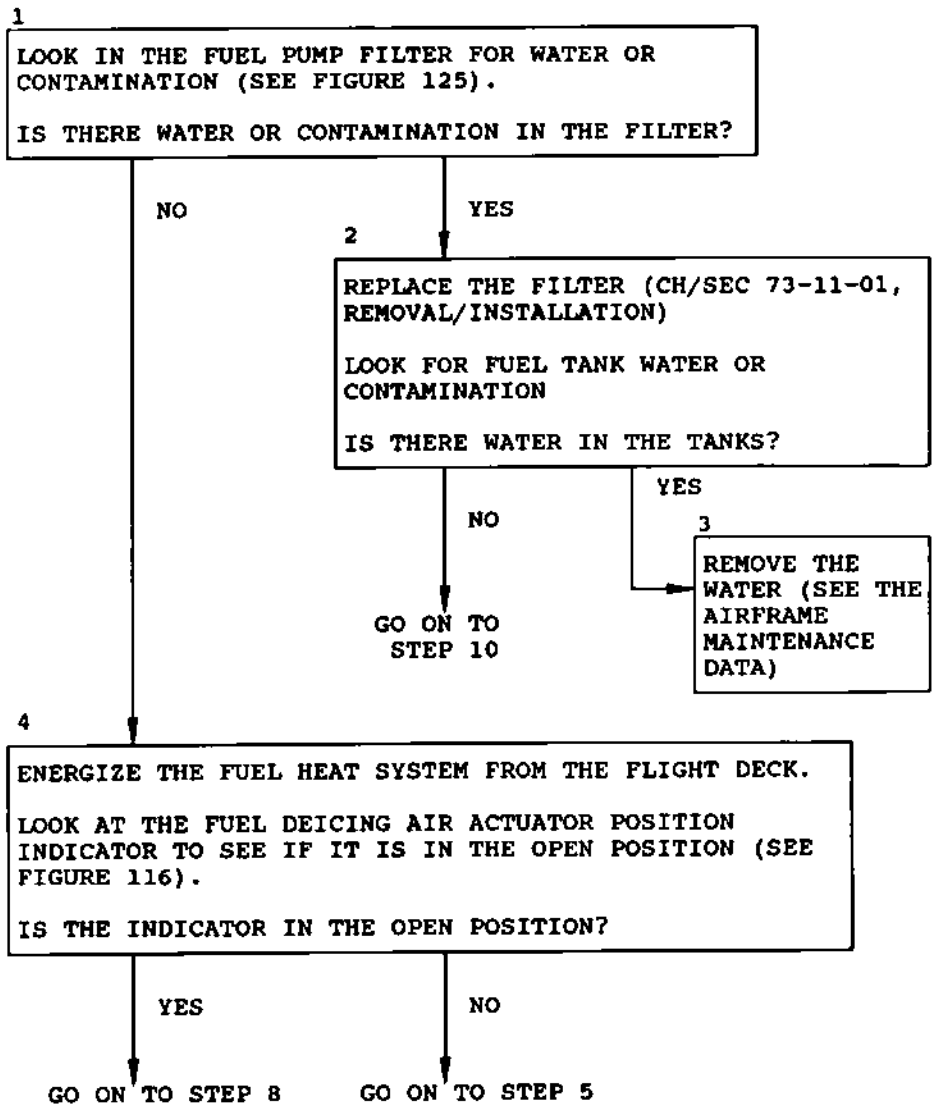
Engine Auto-Accelerates
Troubleshooting
Figure 126 (Sheet 1)
(Task 72-00-00-810-006)

ENGINE AUTO-ACCELERATES (CONTINUED)


FROM STEP 1
6
REPLACE THE ENGINE (DO NOT USE THE FUEL PUMP AND CONTROL FROM THE REMOVED ENGINE ON THE REPLACEMENT ENGINE (IT IS POSSIBLE THAT THIS FUEL PUMP AND CONTROL WAS THE CAUSE OF THE AUTO-ACCELERATION).
FROM STEP 5
7
DO A CHECK OF THE AIRFRAME AUTO-THROTTLE SYSTEM (SEE THE APPLICABLE AIRFRAME MAINTENANCE DATA)
IS THE AUTO-THROTTLE SYSTEM OK?
8
DO A CHECK OF THE AIRFRAME AUTO-THROTTLE SYSTEM (SEE THE APPLICABLE AIRFRAME MAINTENANCE DATA)
IS THE AUTO-THROTTLE SYSTEM OK?
YES
NO
NO
YES
9
THE FUEL PUMP AND CONTROL OF THE REMOVED ENGINE CAN BE THE CAUSE - SEND TO OVERHAUL
10
REPAIR THE AUTO-THROTTLE SYSTEM
11
MAKE SURE FLIGHT PROCEDURES ARE CORRECT
L-H1749

Engine Auto-Accelerates
Troubleshooting
Figure 126 (Sheet 2)
(Task 72-00-00-810-006)

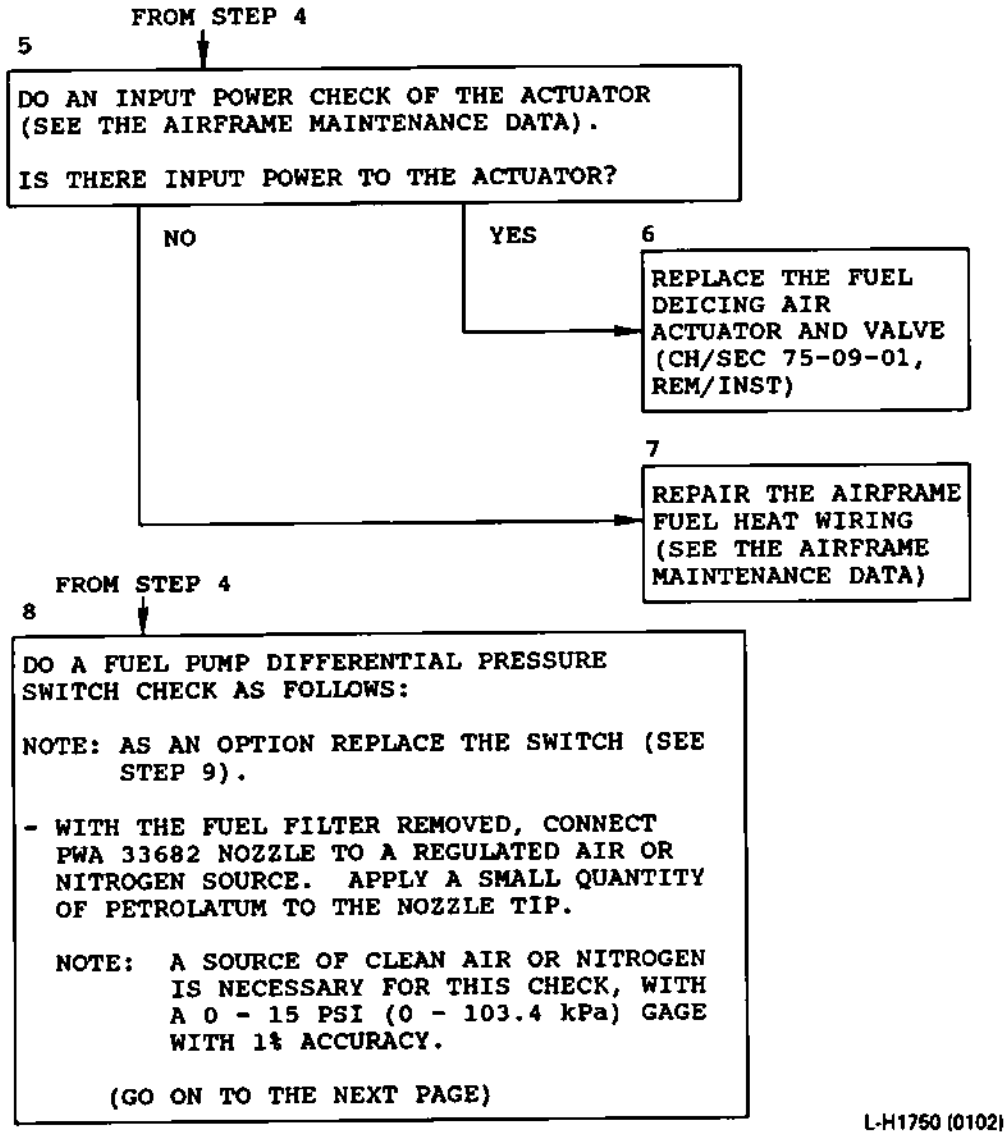
FUEL FILTER DELTA P LIGHT STAYS ON WHEN FUEL HEAT IS ENERGIZED


1
LOOK IN THE FUEL PUMP FILTER FOR WATER OR CONTAMINATION (SEE FIGURE 125).
IS THERE WATER OR CONTAMINATION IN THE FILTER?
NO
YES
2
REPLACE THE FILTER (CH/SEC 73-11-01, REMOVAL/INSTALLATION)
LOOK FOR FUEL TANK WATER OR CONTAMINATION
IS THERE WATER IN THE TANKS?
YES
NO
3
REMOVE THE WATER (SEE THE AIRFRAME MAINTENANCE DATA)
GO ON TO STEP 10
4
ENERGIZE THE FUEL HEAT SYSTEM FROM THE FLIGHT DECK.
LOOK AT THE FUEL DEICING AIR ACTUATOR POSITION INDICATOR TO SEE IF IT IS IN THE OPEN POSITION (SEE FIGURE 116).
IS THE INDICATOR IN THE OPEN POSITION?
YES
NO
GO ON TO STEP 8
GO ON TO STEP 5

L-H1744 (0102)

Fuel Filter Delta P
Light Troubleshooting
Figure 127 (Sheet 1)
(Task 72-00-00-810-006)

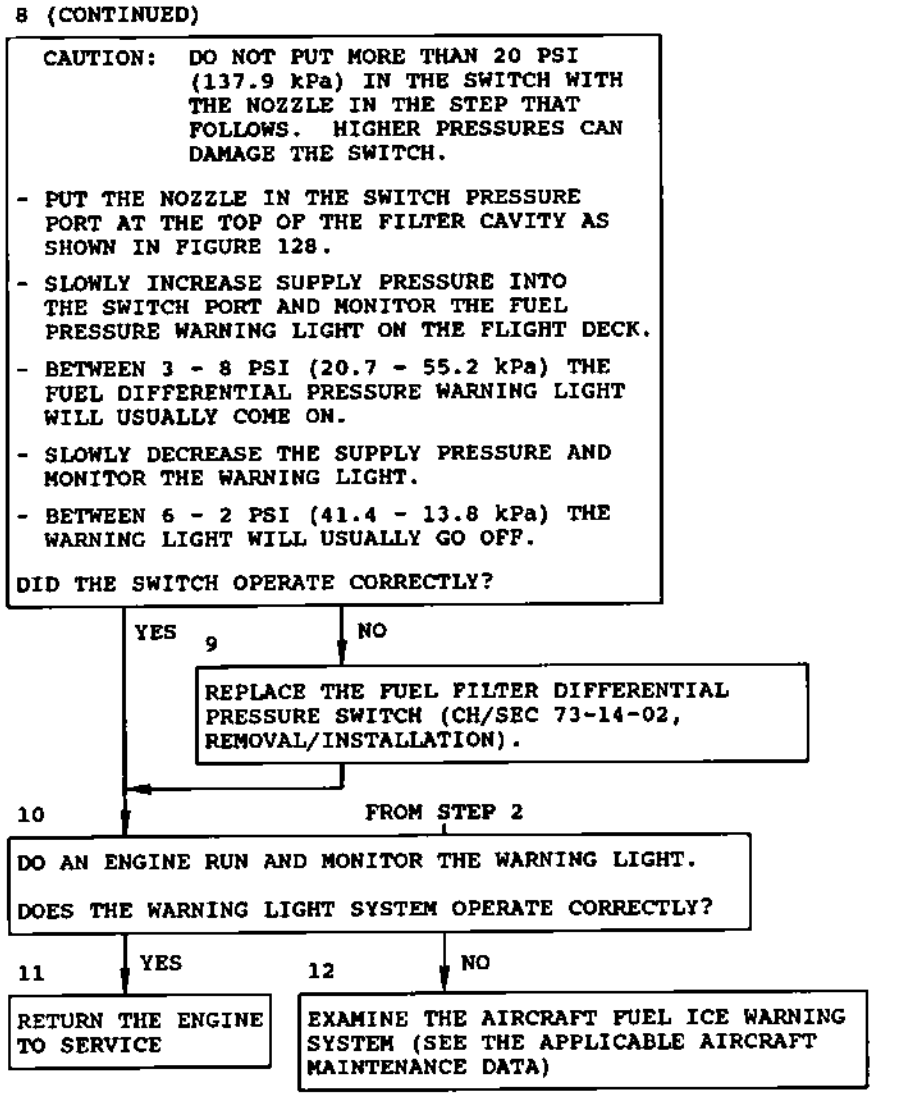
FUEL FILTER DELTA P LIGHT STAYS ON WHEN FUEL HEAT IS ENERGIZED (CONTINUED)


FROM STEP 4
5
DO AN INPUT POWER CHECK OF THE ACTUATOR (SEE THE AIRFRAME MAINTENANCE DATA).
IS THERE INPUT POWER TO THE ACTUATOR?
NO
YES
6
REPLACE THE FUEL DEICING AIR ACTUATOR AND VALVE (CH/SEC 75-09-01, REM/INST)
7
REPAIR THE AIRFRAME FUEL HEAT WIRING (SEE THE AIRFRAME MAINTENANCE DATA)
FROM STEP 4
8
DO A FUEL PUMP DIFFERENTIAL PRESSURE SWITCH CHECK AS FOLLOWS:
NOTE: AS AN OPTION REPLACE THE SWITCH (SEE STEP 9).
- WITH THE FUEL FILTER REMOVED, CONNECT PWA 33682 NOZZLE TO A REGULATED AIR OR NITROGEN SOURCE. APPLY A SMALL QUANTITY OF PETROLATUM TO THE NOZZLE TIP.
NOTE: A SOURCE OF CLEAN AIR OR NITROGEN IS NECESSARY FOR THIS CHECK, WITH A 0 - 15 PSI (0 - 103.4 kPa) GAGE WITH 1% ACCURACY.
(GO ON TO THE NEXT PAGE)

L-H1750 (0102)

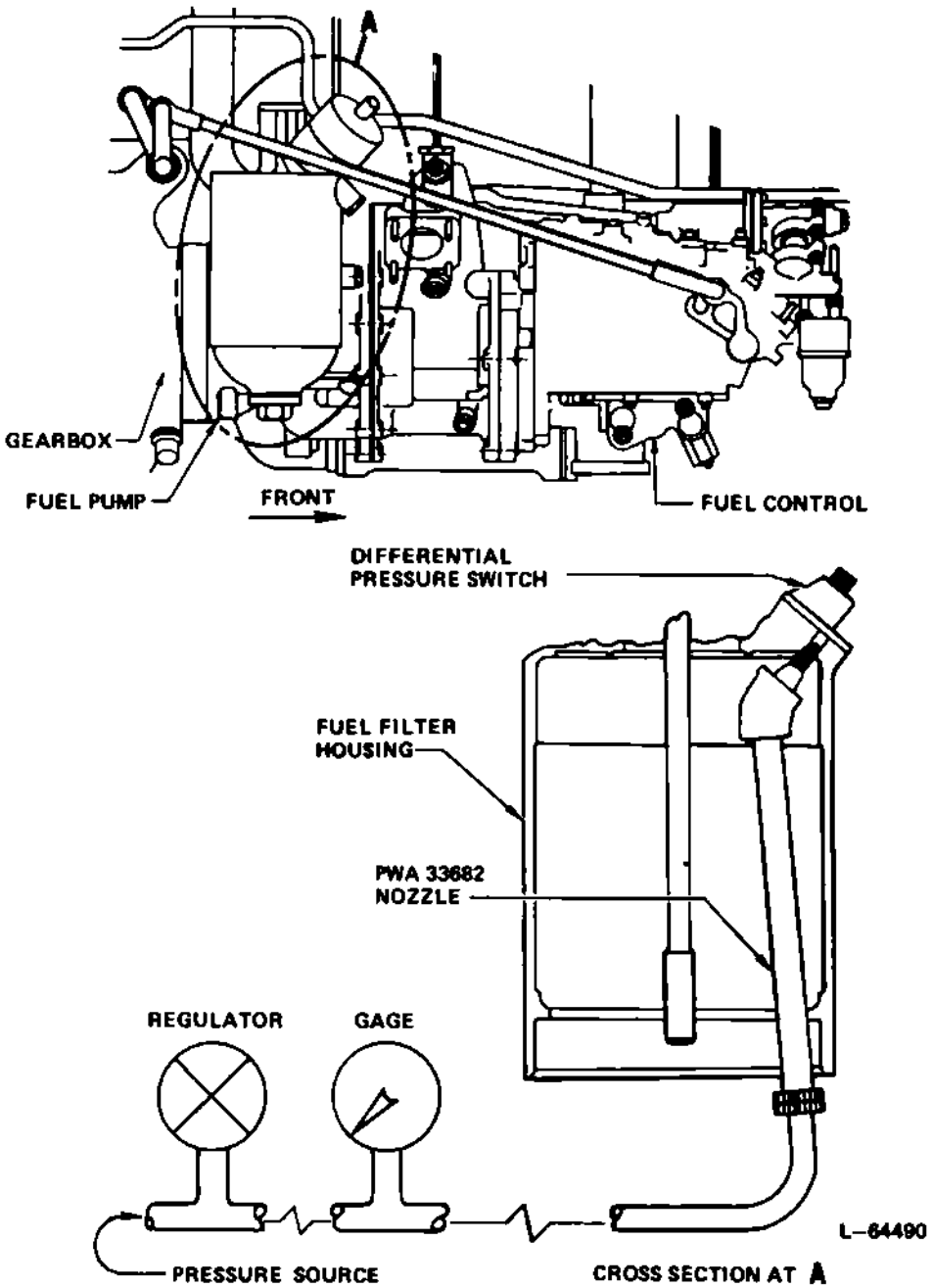
Fuel Filter Delta P
Light Troubleshooting
Figure 127 (Sheet 2)
(Task 72-00-00-810-006)

FUEL FILTER DELTA P LIGHT STAYS ON WHEN FUEL HEAT IS ENERGIZED (CONTINUED)

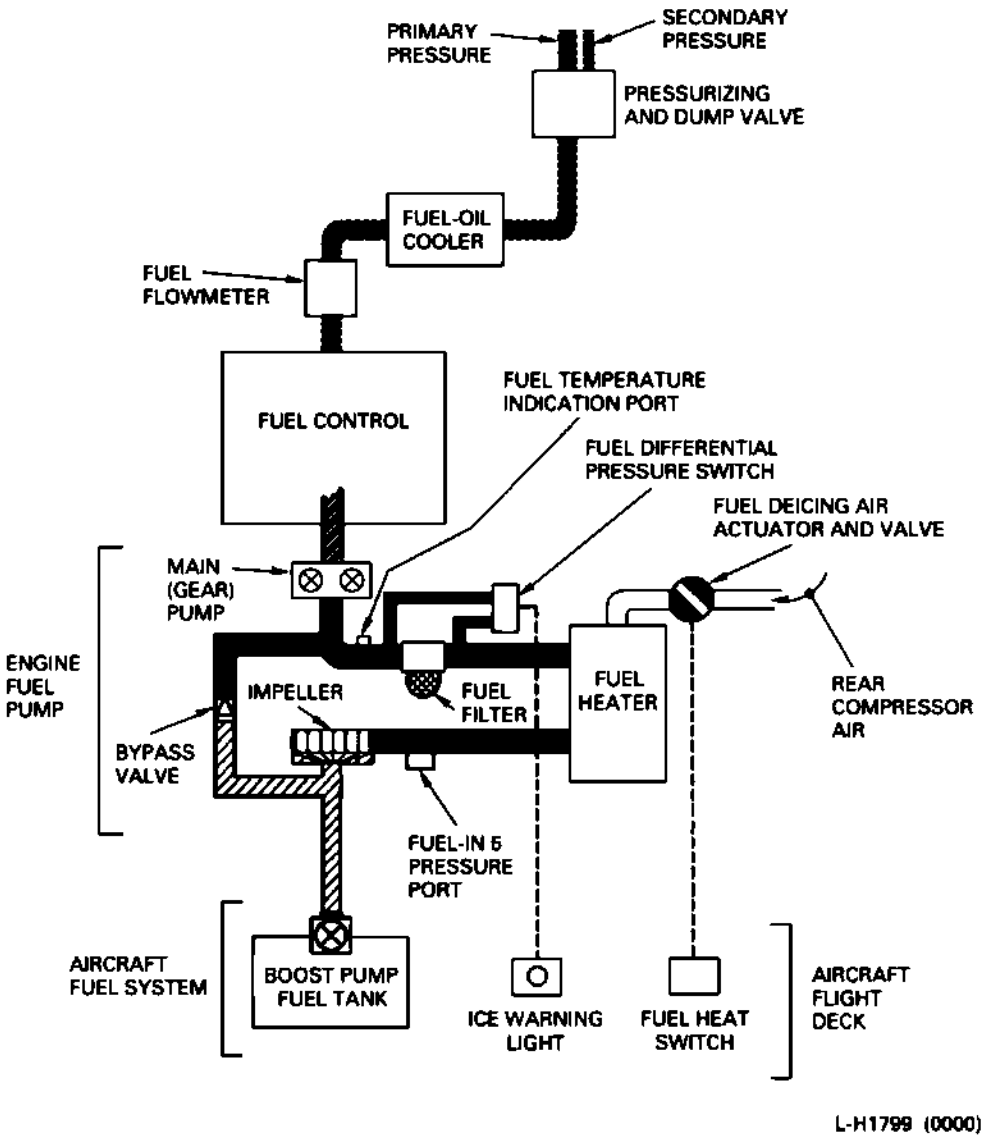

8 (CONTINUED)
CAUTION: DO NOT PUT MORE THAN 20 PSI (137.9 kPa) IN THE SWITCH WITH THE NOZZLE IN THE STEP THAT FOLLOWS. HIGHER PRESSURES CAN DAMAGE THE SWITCH.
- PUT THE NOZZLE IN THE SWITCH PRESSURE PORT AT THE TOP OF THE FILTER CAVITY AS SHOWN IN FIGURE 128.
- SLOWLY INCREASE SUPPLY PRESSURE INTO THE SWITCH PORT AND MONITOR THE FUEL PRESSURE WARNING LIGHT ON THE FLIGHT DECK.
- BETWEEN 3 - 8 PSI (20.7 - 55.2 kPa) THE FUEL DIFFERENTIAL PRESSURE WARNING LIGHT WILL USUALLY COME ON.
- SLOWLY DECREASE THE SUPPLY PRESSURE AND MONITOR THE WARNING LIGHT.
- BETWEEN 6 - 2 PSI (41.4 - 13.8 kPa) THE WARNING LIGHT WILL USUALLY GO OFF.
DID THE SWITCH OPERATE CORRECTLY?
YES
NO
9
REPLACE THE FUEL FILTER DIFFERENTIAL PRESSURE SWITCH (CH/SEC 73-14-02, REMOVAL/INSTALLATION).
10
FROM STEP 2
DO AN ENGINE RUN AND MONITOR THE WARNING LIGHT.
DOES THE WARNING LIGHT SYSTEM OPERATE CORRECTLY?
11
YES
12
NO
RETURN THE ENGINE TO SERVICE
EXAMINE THE AIRCRAFT FUEL ICE WARNING SYSTEM (SEE THE APPLICABLE AIRCRAFT MAINTENANCE DATA)

L-H1751 (0102)

Fuel Filter Delta P
Light Troubleshooting
Figure 127 (Sheet 3)
(Task 72-00-00-810-006)

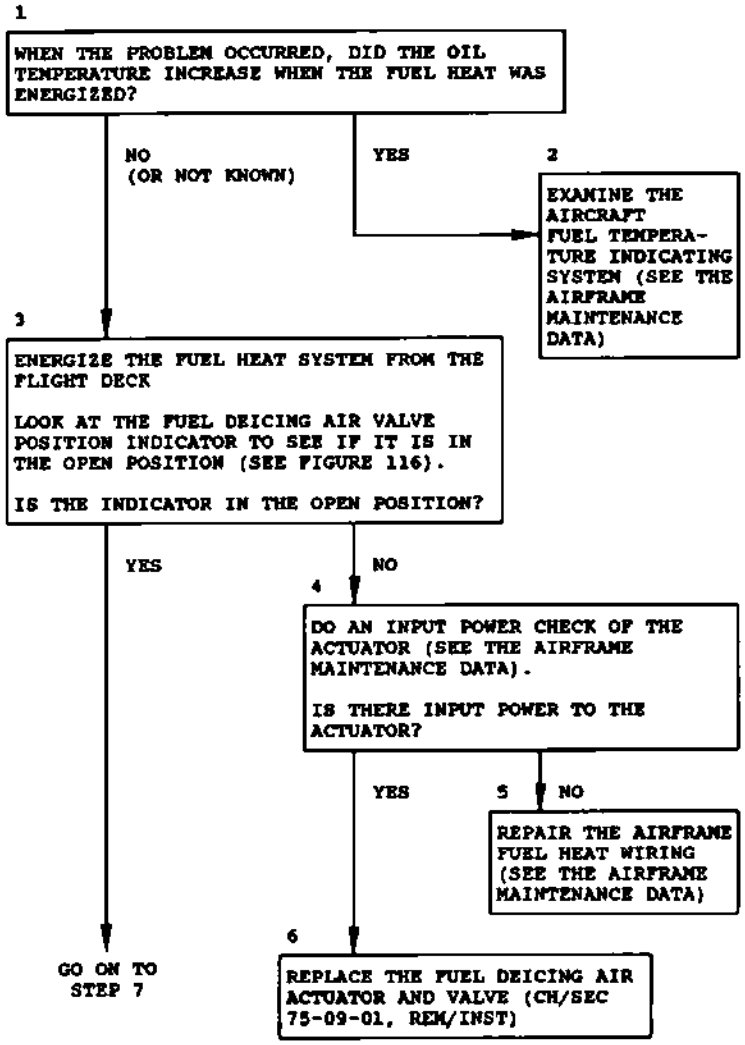


Fuel Differential
Pressure Switch Check
Figure 128
(Task 72-00-00-810-006)



Fuel Deicing System Schematic
Figure 129
(Task 72-00-00-810-006)

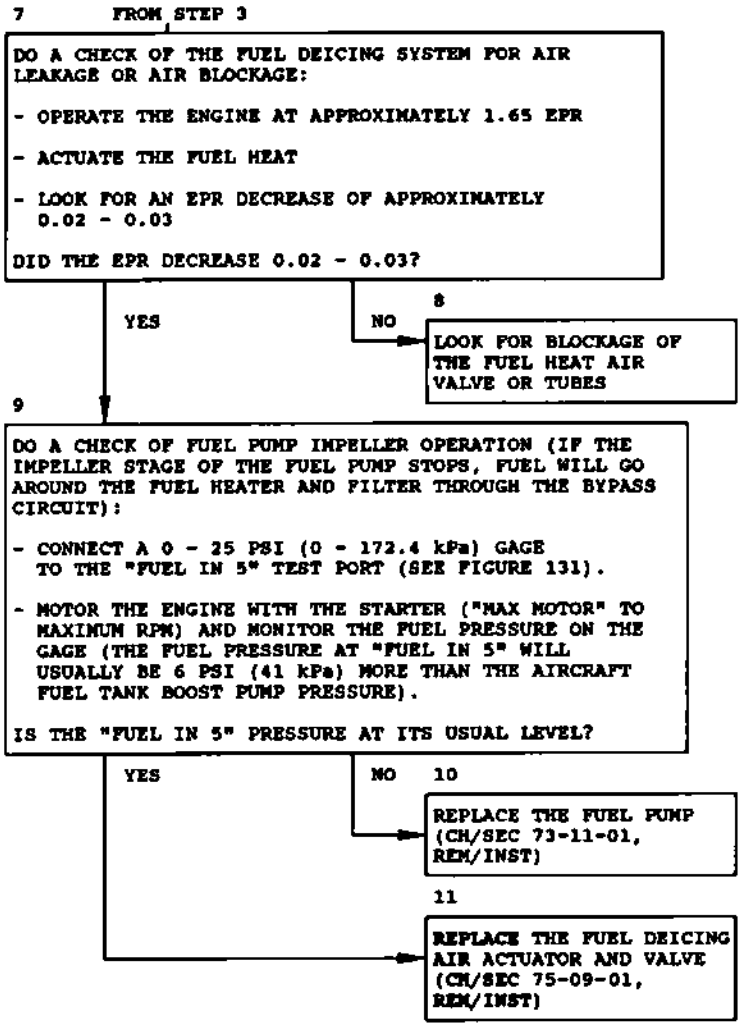
FUEL TEMPERATURE DOES NOT INCREASE WHEN FUEL HEAT IS ENERGIZED (DC-9 INSTALLATIONS ONLY)


1
WHEN THE PROBLEM OCCURRED, DID THE OIL TEMPERATURE INCREASE WHEN THE FUEL HEAT WAS ENERGIZED?
NO (OR NOT KNOWN)
YES
2
EXAMINE THE AIRCRAFT FUEL TEMPERATURE INDICATING SYSTEM (SEE THE AIRFRAME MAINTENANCE DATA)
3
ENERGIZE THE FUEL HEAT SYSTEM FROM THE FLIGHT DECK
LOOK AT THE FUEL DEICING AIR VALVE POSITION INDICATOR TO SEE IF IT IS IN THE OPEN POSITION (SEE FIGURE 116).
IS THE INDICATOR IN THE OPEN POSITION?
YES
NO
4
DO AN INPUT POWER CHECK OF THE ACTUATOR (SEE THE AIRFRAME MAINTENANCE DATA).
IS THERE INPUT POWER TO THE ACTUATOR?
YES
5
NO
REPAIR THE AIRFRAME FUEL HEAT WIRING (SEE THE AIRFRAME MAINTENANCE DATA)
6
GO ON TO STEP 7
REPLACE THE FUEL DEICING AIR ACTUATOR AND VALVE (CH/SEC 75-09-01, REM/INST)

L-H1802 (0102)

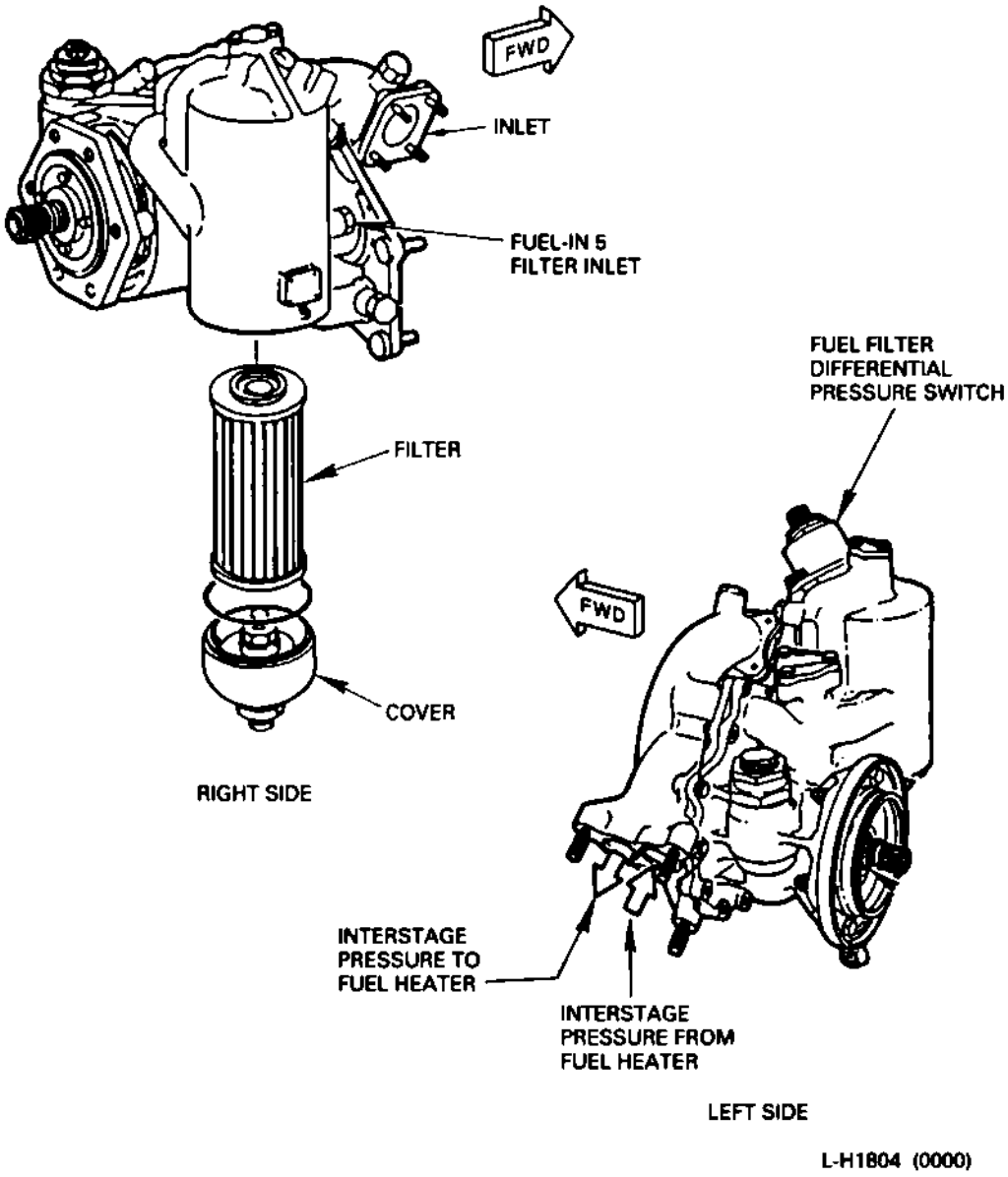
Fuel Temperature Does Not Increase Troubleshooting
Figure 130 (Sheet 1)
(Task 72-00-00-810-006)

FUEL TEMPERATURE DOES NOT INCREASE WHEN FUEL HEAT IS ENERGIZED (CONTINUED)


7
FROM STEP 3
DO A CHECK OF THE FUEL DEICING SYSTEM FOR AIR LEAKAGE OR AIR BLOCKAGE:
- OPERATE THE ENGINE AT APPROXIMATELY 1.65 EPR
- ACTUATE THE FUEL HEAT
- LOOK FOR AN EPR DECREASE OF APPROXIMATELY 0.02 - 0.03
DID THE EPR DECREASE 0.02 - 0.03?
YES
NO
8
LOOK FOR BLOCKAGE OF THE FUEL HEAT AIR VALVE OR TUBES
9
DO A CHECK OF FUEL PUMP IMPELLER OPERATION (IF THE IMPELLER STAGE OF THE FUEL PUMP STOPS, FUEL WILL GO AROUND THE FUEL HEATER AND FILTER THROUGH THE BYPASS CIRCUIT):
- CONNECT A 0 - 25 PSI (0 - 172.4 kPa) GAGE TO THE "FUEL IN 5" TEST PORT (SEE FIGURE 131).
- MOTOR THE ENGINE WITH THE STARTER ("MAX MOTOR" TO MAXIMUM RPM) AND MONITOR THE FUEL PRESSURE ON THE GAGE (THE FUEL PRESSURE AT "FUEL IN 5" WILL USUALLY BE 6 PSI (41 kPa) MORE THAN THE AIRCRAFT FUEL TANK BOOST PUMP PRESSURE).
IS THE "FUEL IN 5" PRESSURE AT ITS USUAL LEVEL?
YES
NO
10
REPLACE THE FUEL PUMP (CH/SEC 73-11-01, REM/INST)
11
REPLACE THE FUEL DEICING AIR ACTUATOR AND VALVE (CH/SEC 75-09-01, REM/INST)

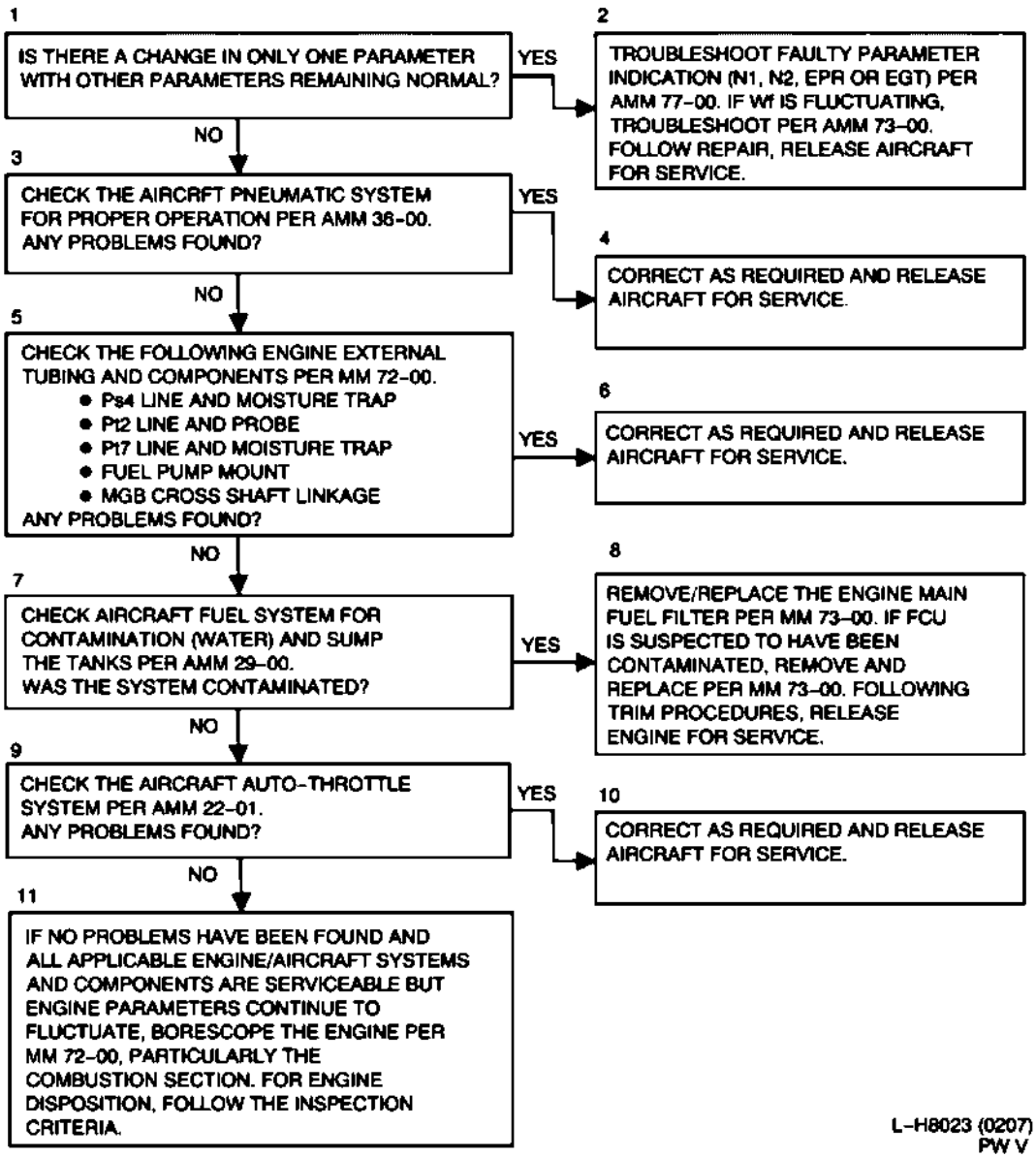
L-H1803 (0102)

Fuel Temperature Does Not Increase Troubleshooting
Figure 130 (Sheet 2)
(Task 72-00-00-810-006)



Fuel Pump Impeller
Pressure Measurement
Figure 131
(Task 72-00-00-810-006)

ENGINE PARAMETER FLUCTUATION


1
IS THERE A CHANGE IN ONLY ONE PARAMETER WITH OTHER PARAMETERS REMAINING NORMAL?
YES
2
TROUBLESHOOT FAULTY PARAMETER INDICATION (N1, N2, EPR OR EGT) PER AMM 77-00. IF Wf IS FLUCTUATING, TROUBLESHOOT PER AMM 73-00. FOLLOW REPAIR, RELEASE AIRCRAFT FOR SERVICE.
NO
3
CHECK THE AIRCRFT PNEUMATIC SYSTEM FOR PROPER OPERATION PER AMM 36-00. ANY PROBLEMS FOUND?
YES
4
CORRECT AS REQUIRED AND RELEASE AIRCRAFT FOR SERVICE.
NO
5
CHECK THE FOLLOWING ENGINE EXTERNAL TUBING AND COMPONENTS PER MM 72-00.
• Ps4 LINE AND MOISTURE TRAP
• Pt2 LINE AND PROBE
• Pt7 LINE AND MOISTURE TRAP
• FUEL PUMP MOUNT
• MGB CROSS SHAFT LINKAGE
ANY PROBLEMS FOUND?
YES
6
CORRECT AS REQUIRED AND RELEASE AIRCRAFT FOR SERVICE.
NO
7
CHECK AIRCRAFT FUEL SYSTEM FOR CONTAMINATION (WATER) AND SUMP THE TANKS PER AMM 29-00. WAS THE SYSTEM CONTAMINATED?
YES
8
REMOVE/REPLACE THE ENGINE MAIN FUEL FILTER PER MM 73-00. IF FCU IS SUSPECTED TO HAVE BEEN CONTAMINATED, REMOVE AND REPLACE PER MM 73-00. FOLLOW TRIM PROCEDURES, RELEASE ENGINE FOR SERVICE.
NO
9
CHECK THE AIRCRAFT AUTO-THROTTLE SYSTEM PER AMM 22-01. ANY PROBLEMS FOUND?
YES
10
CORRECT AS REQUIRED AND RELEASE AIRCRAFT FOR SERVICE.
NO
11
IF NO PROBLEMS HAVE BEEN FOUND AND ALL APPLICABLE ENGINE/AIRCRAFT SYSTEMS AND COMPONENTS ARE SERVICEABLE BUT ENGINE PARAMETERS CONTINUE TO FLUCTUATE, BORESCOPE THE ENGINE PER MM 72-00, PARTICULARLY THE COMBUSTION SECTION. FOR ENGINE DISPOSITION, FOLLOW THE INSPECTION CRITERIA.

L-H8023 (0207)
PW V

Engine Parameter Fluctuation
Figure 132
(Task 72-00-00-810-006)

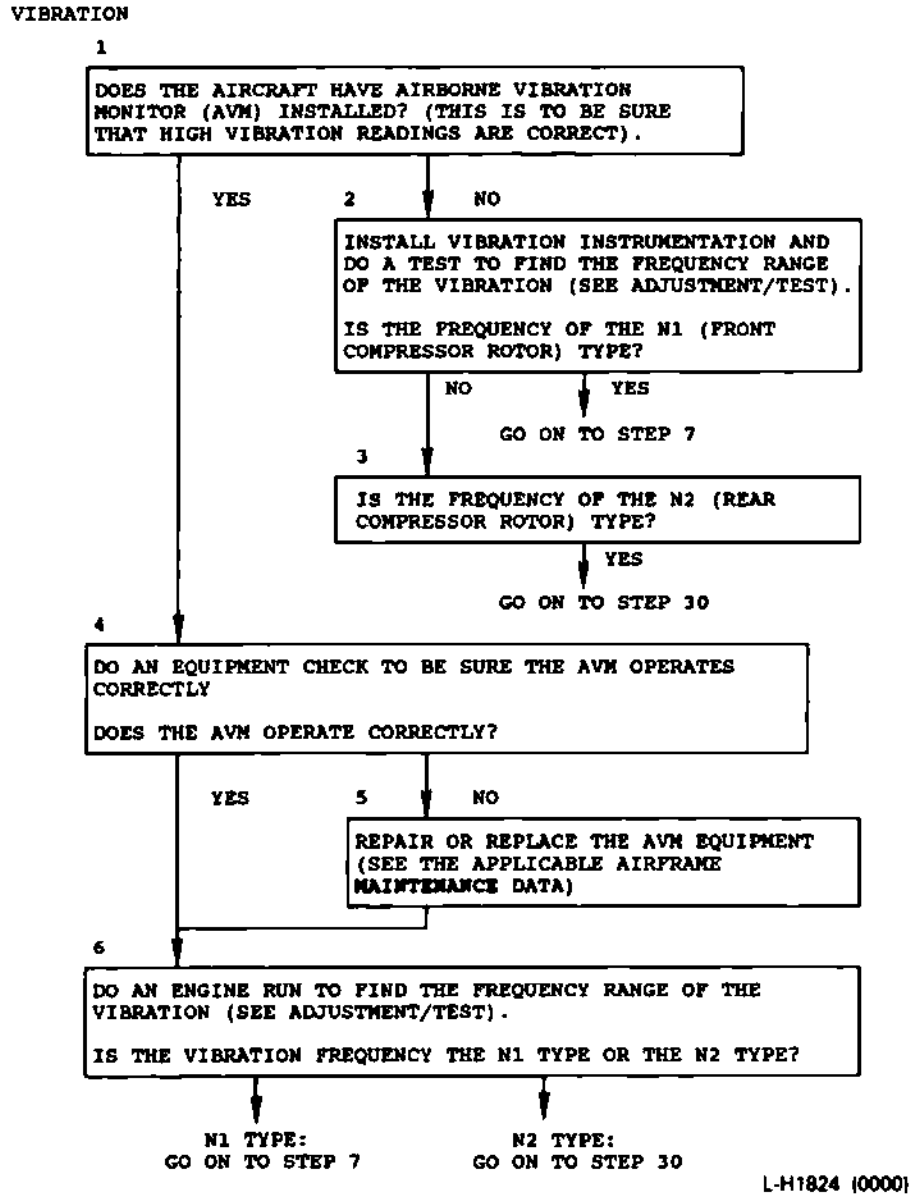
Task 72-00-00-810-007:

1. Vibration Troubleshooting

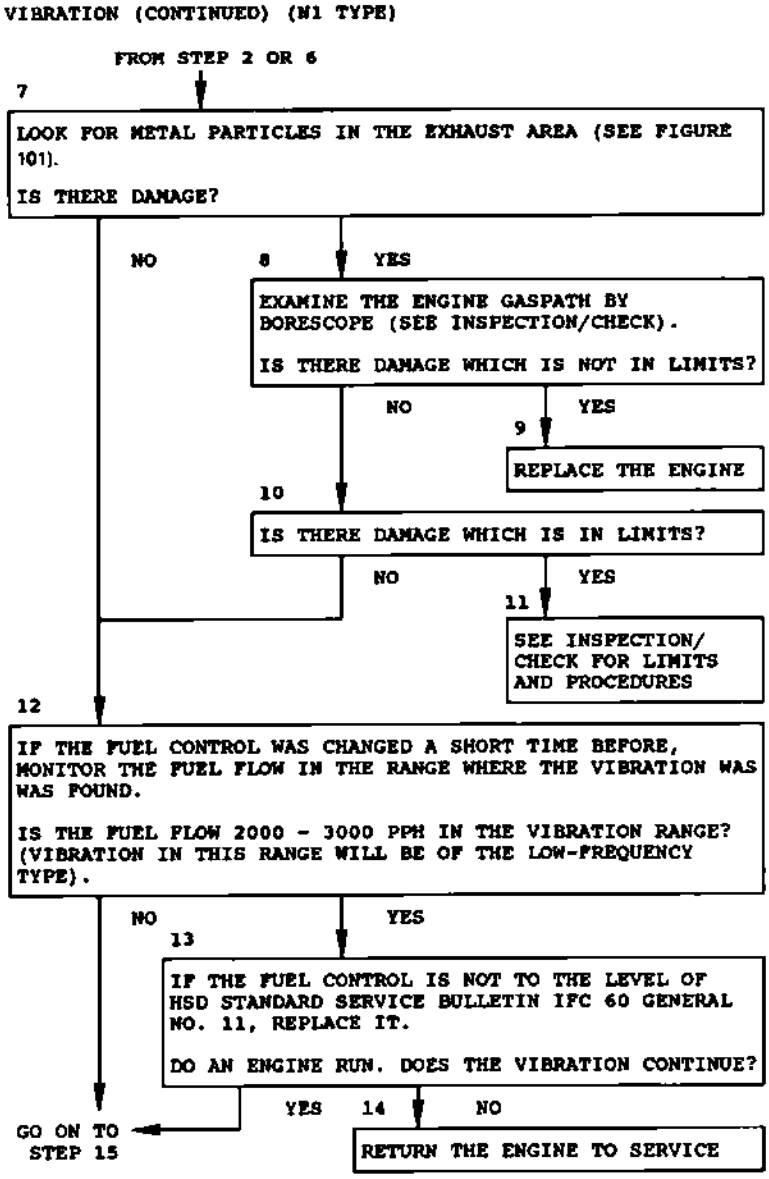
A. General

(1) Engine vibration can occur when engine parts are loose or when rotors or parts of rotors are not balanced. When vibration is found, it is important to know as much as possible about:
- How the vibration was measured
- Where the vibration is estimated to be (front compressor or rear compressor rotor)
- What the engine maintenance history is (what rotor parts wear replaced, what type of parts or components were used).

B. Procedures
See Figure 101 and Figure 102.

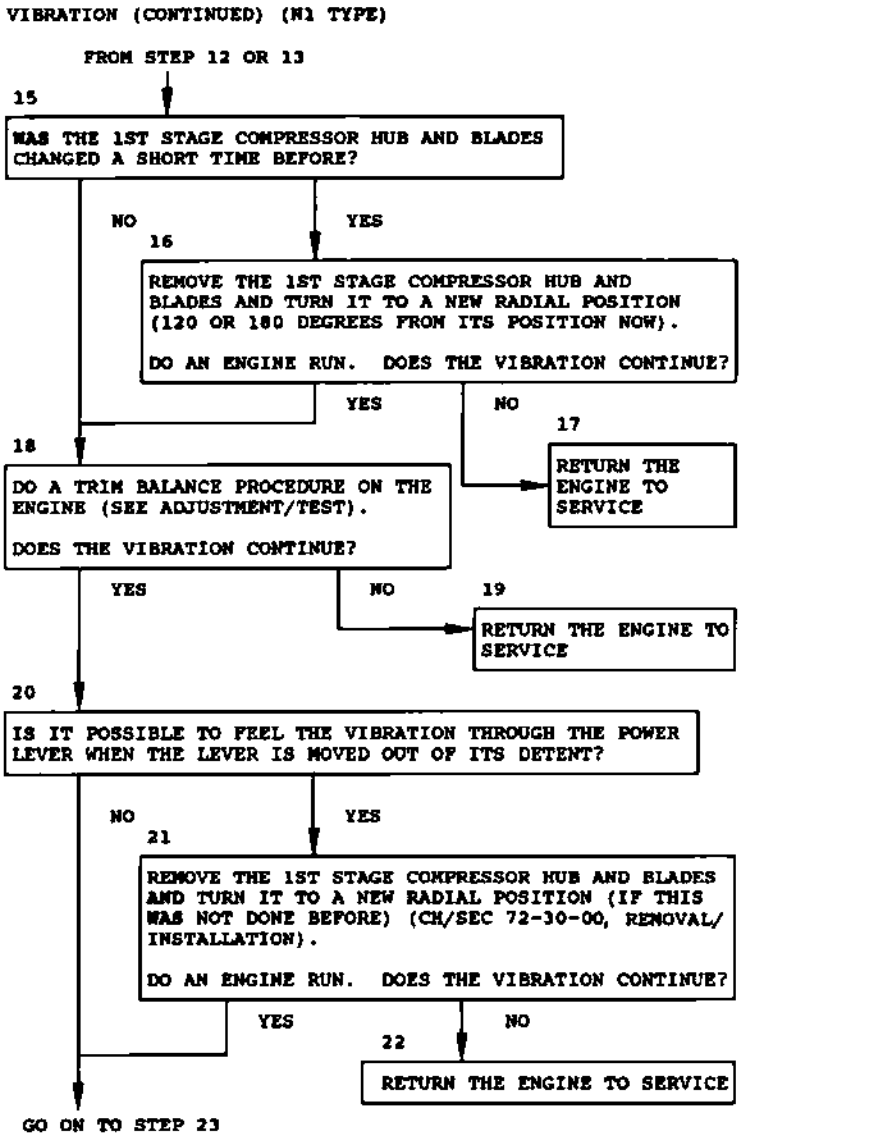

VIBRATION
1
DOES THE AIRCRAFT HAVE AIRBORNE VIBRATION MONITOR (AVM) INSTALLED? (THIS IS TO BE SURE THAT HIGH VIBRATION READINGS ARE CORRECT).
YES
2
NO
INSTALL VIBRATION INSTRUMENTATION AND DO A TEST TO FIND THE FREQUENCY RANGE OF THE VIBRATION (SEE ADJUSTMENT/TEST).
IS THE FREQUENCY OF THE N1 (FRONT COMPRESSOR ROTOR) TYPE?
NO
YES
GO ON TO STEP 7
3
IS THE FREQUENCY OF THE N2 (REAR COMPRESSOR ROTOR) TYPE?
YES
GO ON TO STEP 30
4
DO AN EQUIPMENT CHECK TO BE SURE THE AVM OPERATES CORRECTLY
DOES THE AVM OPERATE CORRECTLY?
YES
5
NO
REPAIR OR REPLACE THE AVM EQUIPMENT (SEE THE APPLICABLE AIRFRAME MAINTENANCE DATA)
6
DO AN ENGINE RUN TO FIND THE FREQUENCY RANGE OF THE VIBRATION (SEE ADJUSTMENT/TEST).
IS THE VIBRATION FREQUENCY THE N1 TYPE OR THE N2 TYPE?
N1 TYPE:
GO ON TO STEP 7
N2 TYPE:
GO ON TO STEP 30
L-H1824 (0000)

Vibration Troubleshooting
Figure 101 (Sheet 1)
(Task 72-00-00-810-007)


VIBRATION (CONTINUED) (N1 TYPE)
FROM STEP 2 OR 6
7
LOOK FOR METAL PARTICLES IN THE EXHAUST AREA (SEE FIGURE 101).
IS THERE DAMAGE?
NO
8
YES
EXAMINE THE ENGINE GASPATH BY BORESCOPE (SEE INSPECTION/CHECK).
IS THERE DAMAGE WHICH IS NOT IN LIMITS?
NO
YES
9
REPLACE THE ENGINE
10
IS THERE DAMAGE WHICH IS IN LIMITS?
NO
YES
11
SEE INSPECTION/ CHECK FOR LIMITS AND PROCEDURES
12
IF THE FUEL CONTROL WAS CHANGED A SHORT TIME BEFORE, MONITOR THE FUEL FLOW IN THE RANGE WHERE THE VIBRATION WAS WAS FOUND.
IS THE FUEL FLOW 2000 - 3000 PPH IN THE VIBRATION RANGE? (VIBRATION IN THIS RANGE WILL BE OF THE LOW-FREQUENCY TYPE).
NO
YES
13
IF THE FUEL CONTROL IS NOT TO THE LEVEL OF HSD STANDARD SERVICE BULLETIN IFC 60 GENERAL NO. 11, REPLACE IT.
DO AN ENGINE RUN. DOES THE VIBRATION CONTINUE?
YES
14
NO
GO ON TO STEP 15
RETURN THE ENGINE TO SERVICE

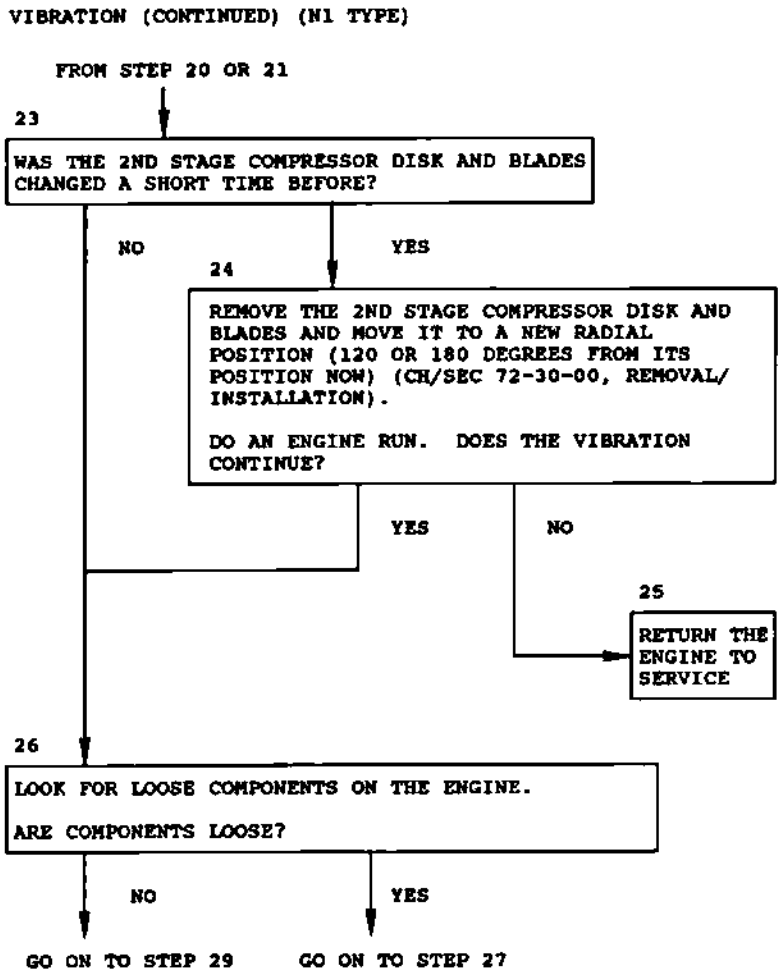
L-H1825 (0593)

Vibration Troubleshooting
Figure 101 (Sheet 2)
(Task 72-00-00-810-007)


VIBRATION (CONTINUED) (N1 TYPE)
FROM STEP 12 OR 13
15
WAS THE 1ST STAGE COMPRESSOR HUB AND BLADES CHANGED A SHORT TIME BEFORE?
NO
YES
16
REMOVE THE 1ST STAGE COMPRESSOR HUB AND BLADES AND TURN IT TO A NEW RADIAL POSITION (120 OR 180 DEGREES FROM ITS POSITION NOW).
DO AN ENGINE RUN. DOES THE VIBRATION CONTINUE?
YES
NO
17
RETURN THE ENGINE TO SERVICE
18
DO A TRIM BALANCE PROCEDURE ON THE ENGINE (SEE ADJUSTMENT/TEST).
DOES THE VIBRATION CONTINUE?
YES
NO
19
RETURN THE ENGINE TO SERVICE
20
IS IT POSSIBLE TO FEEL THE VIBRATION THROUGH THE POWER LEVER WHEN THE LEVER IS MOVED OUT OF ITS DETENT?
NO
YES
21
REMOVE THE 1ST STAGE COMPRESSOR HUB AND BLADES AND TURN IT TO A NEW RADIAL POSITION (IF THIS WAS NOT DONE BEFORE) (CH/SEC 72-30-00, REMOVAL/INSTALLATION).
DO AN ENGINE RUN. DOES THE VIBRATION CONTINUE?
YES
NO
22
RETURN THE ENGINE TO SERVICE
GO ON TO STEP 23

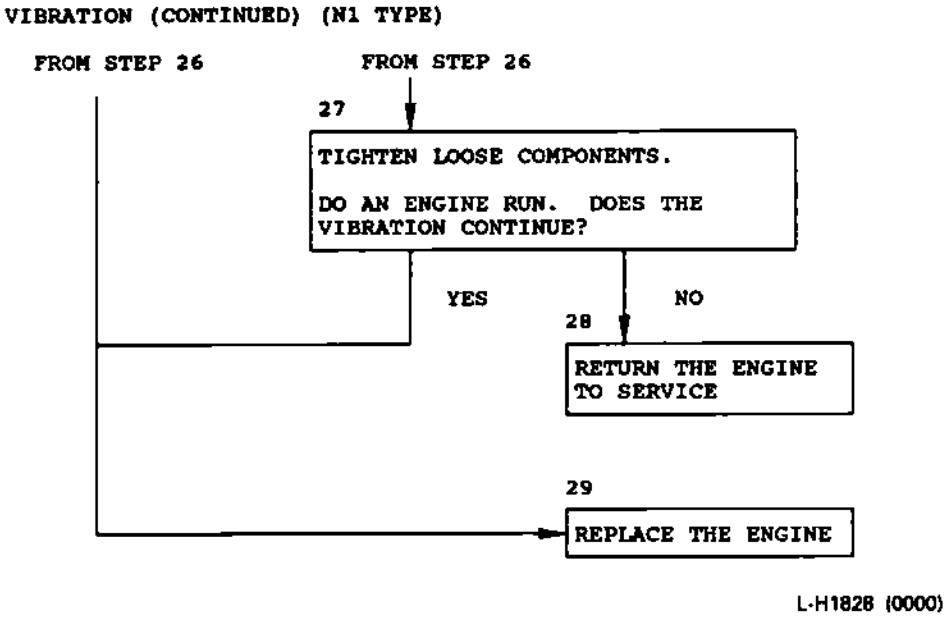
L-H1826 (0102)

Vibration Troubleshooting
Figure 101 (Sheet 3)
(Task 72-00-00-810-007)

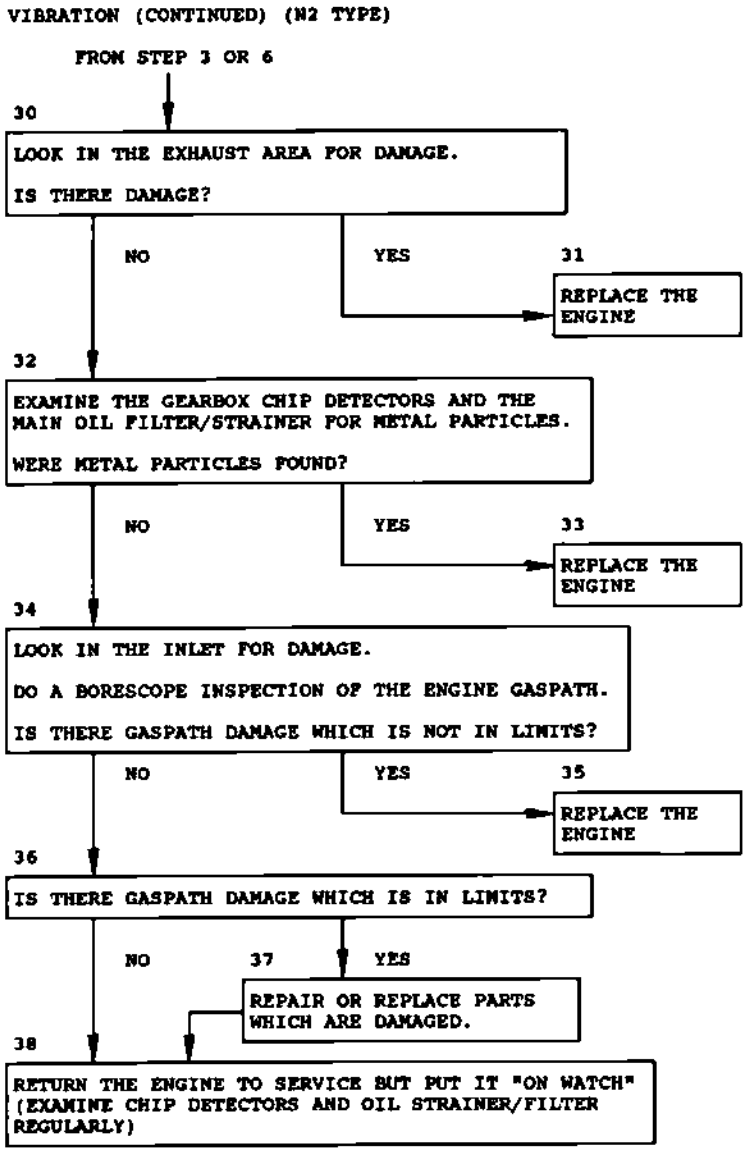

VIBRATION (CONTINUED) (N1 TYPE)
FROM STEP 20 OR 21
23
WAS THE 2ND STAGE COMPRESSOR DISK AND BLADES CHANGED A SHORT TIME BEFORE?
NO
YES
24
REMOVE THE 2ND STAGE COMPRESSOR DISK AND BLADES AND MOVE IT TO A NEW RADIAL POSITION (120 OR 180 DEGREES FROM ITS POSITION NOW) (CH/SEC 72-30-00, REMOVAL/ INSTALLATION).
DO AN ENGINE RUN. DOES THE VIBRATION CONTINUE?
YES
NO
25
RETURN THE ENGINE TO SERVICE
26
LOOK FOR LOOSE COMPONENTS ON THE ENGINE.
ARE COMPONENTS LOOSE?
NO
YES
GO ON TO STEP 29
GO ON TO STEP 27

L-H1827 (0102)

Vibration Troubleshooting
Figure 101 (Sheet 4)
(Task 72-00-00-810-007)

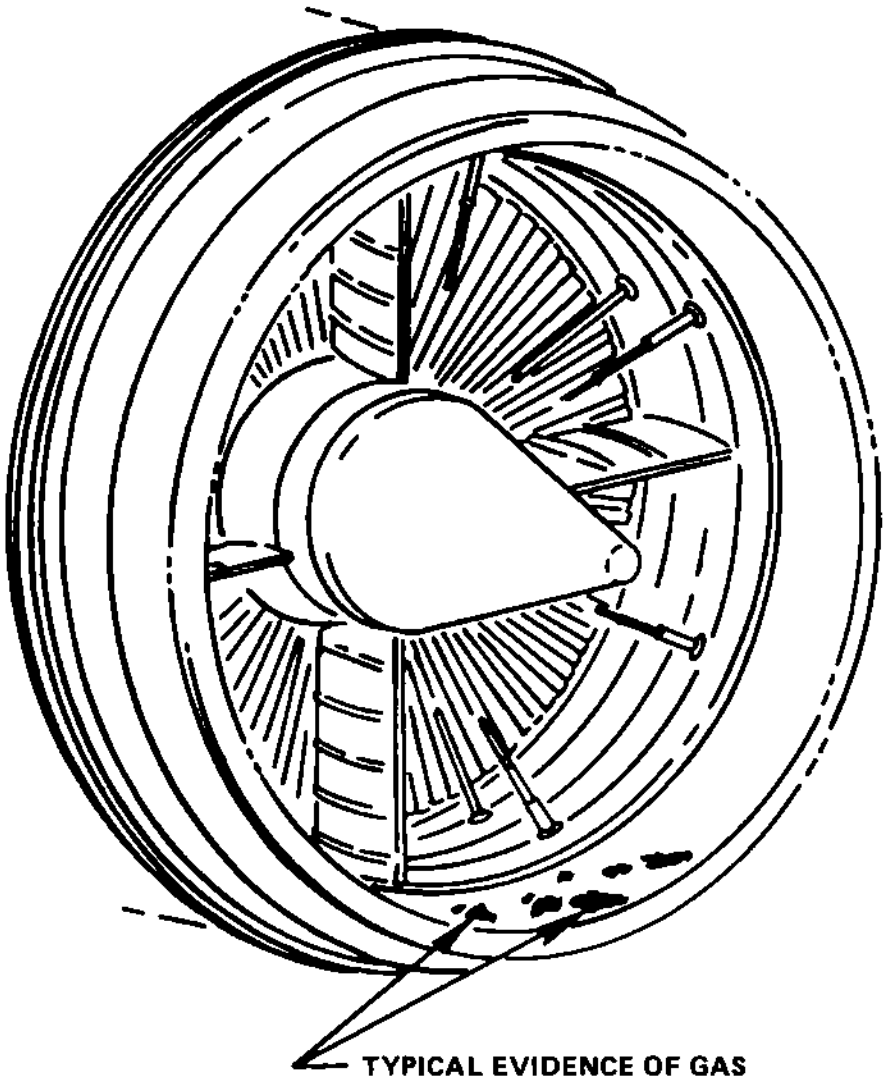


Vibration Troubleshooting
Figure 101 (Sheet 5)
(Task 72-00-00-810-007)



L-H1829 (0000)

Vibration Troubleshooting
Figure 101 (Sheet 6)
(Task 72-00-00-810-007)



Exhaust Area Inspection
Figure 102
(Task 72-00-00-810-007)

Task 72-00-00-610-001:

1. Periodic Inspection

A. The life of the JT8D engine and its associated equipment is determined by operational conditions. The inspection system must anticipate these conditions. See Inspection/Check section.

Task 72-00-00-610-002:

2. Repair

A. The permissible repair procedures for maintenance are given in the applicable sections.

Task 72-00-00-610-003:

3. Preservation/Depreservation

CAUTION: IF AN ENGINE IS STORED WITHOUT THE PRESERVATION PROCEDURES IN THIS SECTION, ADDED INSPECTION AND MAINTENANCE PROCEDURES WILL BE NECESSARY BEFORE THIS ENGINE CAN GO BACK INTO SERVICE. REFER TO PARAGRAPH F.

A. Engine Preservation Schedule

CAUTION: UNDER NO CIRCUMSTANCES SHALL PRESERVATIVE OIL BE SPRAYED INTO THE COMPRESSOR OR TURBINE END OF THE ENGINE. DIRT PARTICLES DEPOSITING ON THE BLADES AND VANES DURING OPERATION WILL ALTER THE AIRFOIL SHAPE AND ADVERSELY AFFECT COMPRESSOR EFFICIENCY.

(1) 0 to 7 days. Engines may be left in an inactive status with no preservation protective requirements provided:

(a) The engine is sheltered.

(b) Humidity is not excessively high.

(c) The engine is not subjected to extreme temperature changes which would produce condensation.

(2) 7 to 28 days. Engines which are to be inactive up to 28 days may have no preservation providing all engine openings are sealed off and the relative humidity in the engine is maintained at less than 40 percent. This can be accomplished by placing approximately 26 pounds of dehydrating agent in the engine inlet and the tailpipe. Place the dehydrating agent on racks to keep it off engine parts. Suitable windows shall be provided in the inlet and the exhaust closures to allow observation of the humidity indicators.

(3) 28 to 90 days. Engines which are to be stored longer than 28 days but not to exceed 90 days need only the fuel system preserved. The engine oil system need not be drained or preserved. Desiccant agents, humidity indicators, engine coverings such as intake, exhaust breather discharge, etc., must be utilized.

(4) 90 plus days. Engine preservation must be complete. Pre- serve the engine oil system and the engine fuel system as described in the following paragraphs.

(5) Engine shut down in flight.

CAUTION: ENGINE SHUT DOWN OR NOT OPERATED IN FLIGHT SHALL BE DRIED OUT IN ACCORDANCE WITH PARAGRAPH 5, SPARE ENGINE TRANSPORTATION AND STORAGE.

(6) Engine awaiting repair or overhaul.

B. Engine Oil System Preservation

CAUTION: ENGINE AWAITING REPAIR OR OVERHAUL MUST HAVE ADEQUATE PRESERVATION MEASURES ACCOMPLISHED UPON REMOVAL OF ENGINE FROM AIRCRAFT.

(1) The following procedures shall be followed for the preservation of engines which are to be inactive for periods exceeding 90 days.

(a) Rotate the engine with the starter or auxiliary power unit at the starter pad until oil pressure and high compressor (N2) speed is indicated. Disengage starter.

(b) Open the drain on the bottom of the oil tank and remove the drain plug from the bottom of the N2 gearbox. Drain all oil into suitable containers.

NOTE: To make it possible to drain the oil from the CSD cavity (between the CSD and the rear face of the gearbox CSD pad), remove the plug and connector together from the LD7 port on the bottom right side of the gearbox. Remove the two packings from the connector and discard them. After the CSD cavity is drained, install two new packings (lubricated with PWA 36500 lubricant) on the connector and install the plug and connector assembly in the LD7 port. The plug in the connector is used during CSD servicing and gives access to the oil tube assembly (standpipe). When oil is added to the cavity, this plug is removed, and when oil flows from the top of the standpipe down to the plug opening, the oil is at the correct level.

(c) With the drains open, motor the engine over to 1600 minimum rpm with the starter, allowing the scavenge pumps to clear the engine, indicated by a cessation of a steady stream of oil from the drains. To prevent excessive operation with limited lubrication, limit the rotation to the shortest possible time to fulfill the above requirement. Starter operating time limits should not be exceeded.

(d) Remove the main oil strainer (if 175-micron type) and rinse the assembly in petroleum solvent.

(e) Allow the engine oil to drain to a slow drip for approximately one-half hour.

(f) Install the oil strainer and close the previously opened drains.

(g) Fill the oil tank with clean oil.

(h) Motor the engine over with the starter until oil pressure indication is observed.

(i) Start and operate the engine for five minutes at 75 percent maximum continuous and shut down engine. Specific engine operating instructions should be observed during the preservation run.

(j) Drain the oil tank and accessory case by opening the oil tank drain and removing the drain plugs and connector from the bottom of the N2 gearbox. Drain the oil into suitable containers.

NOTE: If oil and fuel systems are to be preserved simultaneously, fuel system preservation procedure should be performed prior to draining oil.

(k) Close the oil tank drain. Coat the N2 gearbox drain plugs with new engine oil and reinstall the connector with packing and drain plugs. Lockwire plugs.

(l) Remove the cover plates from the pads of accessory drives upon which accessories are not installed and spray the exposed surfaces with new engine oil. Reinstall the cover plates.

(m) Plugs, caps, covers or screens should be installed over all openings to prohibit the entrance of foreign material and accumulation of moisture.

(n) If the engine is to remain in the aircraft, install 52 pounds of dehydrating agent, distributing 26 pounds in the compartment. The balance should be distributed equally in aircraft inlet and exhaust section.

(o) Oil filler caps should be tagged as to the date of preservation. Using an air tight moisture barrier or other suitable covers, cover the air inlet and exhaust end of the engine compartment, installing a humidity indicator at each end. Inspection windows at each end should be provided through which the indicators will be visible.

(p) Inspection of the preserved unit should be made every two weeks if the aircraft is stored outside or every 30 days if the aircraft is stored inside. If the relative humidity as indicated on the humidity cards is 40 percent or less, no further action is required. If humidity indicator on silica gel bags indicates 40 percent or higher, entire engine system, including fuel and oil, should be depreserved and represerved.

C. Fuel System Preservation

(1) Disconnect fuel-in supply at inlet pad of fuel pump and connect a supply of filtered slushing oil at an inlet pressure of 5 - 25 psi and a minimum temperature of 60°F (15.6°C). Extreme care should be taken to prevent foreign material from being drawn into the engine fuel system. Equipment should be provided with suitable filters and/or strainers of no coarser mesh than used in the engine. A ten micron filter is recommended for this purpose.

NOTE: Filtered slushing oil should be a light mineral based oil equivalent to MIL-L-6081 Grade 1010 which is mixable with fuel and test fluids and compatible with fuel system materials. Oil meeting this criteria is available through most major oil suppliers.

(2) Remove fuel pressurizing and dump valve strainer and cover at rear of pressurizing and dump valve.

(3) Install PWA 12386 Adapter on pressurizing and dump valve in place of cover.

(4) Attach standard hose from adapter to suitable container having minimum capacity of six gallons.

(5) With ignition switch off and fuel shutoff valves OPEN, move fuel control lever to full OPEN position. Motor engine with starter at minimum N2 speed of 1600 rpm until at least two gallons of oil are discharged from pressurizing and dump valve filter cavity. During motoring period fuel shutoff valve should be moved from open to closed to open to purge bypass system.

(6) Replace pressurizing and dump valve filter cover, using new packing coated with petrolatum, and connect fuel supply line.

(7) Fuel control power lever should be tagged as to preservative used and date of preservation.

D. Engine Depreservation Schedule

(1) 0 - 28 days. No depreservation required.

(2) 28 - 90 days. Depreserve fuel system.

(3) 90 plus days. Complete depreservation is required.

E. Engine Depreservation

NOTE: Check all oil passages for obstructions before installation of accessories which are dependent on engine oil.

NOTE: Use the procedures in this paragraph if the engine was preserved by the procedures applicable to the time the engine was stored. Refer to the paragraph that follows if the engine did not get the applicable preservation procedures for the time the engine was in storage.

(1) Remove all moisture barriers, humidity indicators, and dehydrating agent.

(2) Fill oil tank with engine lubricating oil.

(3) Connect fuel supply line to fuel inlet pad.

(4) Place suitable container having minimum capacity of six gallons under fuel pressurizing and dump valve.

(5) Remove strainer and cover assembly from fuel pressurizing and dump valve.

(6) Install PWA 12386 Adapter on fuel pressurizing and dump valve in place of cover and connect suitable length of hose to adapter outlet fitting to drain fuel into six-gallon container.

(7) With ignition OFF, fuel shutoff valve OPEN, and fuel control lever in full open position, motor engine over with starter on external power source to high rotor (N2) speed of 1600 rpm minimum.

CAUTION: ROTATION OF ENGINE SHOULD BE LIMITED TO SHORTEST POSSIBLE TIME IN ORDER NOT TO EXCEED STARTER OPERATING LIMIT.

(8) When at least two gallons of fluid have been discharged from overboard dump line, move fuel control lever to closed position and disengage starter.

(9) Replace fuel pressurizing and dump valve strainer using new packing lubricated with PWA 36500 Assembly Fluid.

CAUTION: IF ENGINE WILL BE STARTED IMMEDIATELY AFTER DEPRESERVATION, CLEAR ENGINE OF FUEL VAPORS BY MOTORING FOR 10 - 20 SECONDS WITH FUEL SHUT OFF. REFER TO ADJUSTMENT/TEST, CLEAR ENGINE PROCEDURE. BEFORE ATTEMPTING ENGINE START, ALLOW EITHER 30 SECOND FUEL DRAINING PERIOD OR PRESCRIBED STARTER COOLING PERIOD, WHICHEVER IS LONGER.

(10) Remove preservation tags and make proper entry in engine records.

F. Engine Inspection And Maintenance Procedures (When Specified Procedures For Engine Preservation Were Not Done)

NOTE: Use the procedures in this paragraph when the engine did not get the preservation specified in this manual for the time period during which the engine was in storage. Some steps are done more than one time because they are specified in the procedures for more than one engine system, but it is permitted to do such steps one time only where applicable.

(1) Oil System Depreservation

NOTE: These procedures are necessary if the 7 - 28 day (gaspath) preservation procedure was not done and the engine storage or inactivity period was more than 7 days, or if the 90-plus day (oil system) procedure was not done and the engine storage or inactivity period was more than 90 days.

(a) Do checks of the main oil filter or strainer (MOF) and magnetic chip detectors (MCD) (if used) and look for contamination. Refer to the JT8D Oil Monitoring Guide, Sections D and E.

1 If MOF and MCD checks show no contamination, install the MOF and MCD units and go on to the subsequent step.

NOTE: It is recommended to clean the MCDs if necessary and to replace the main oil filter/strainer with a new element at this time to prevent false indications after the engine run specified below.

2 If MOF and MCD checks are not satisfactory, do the necessary corrective action (disassemble the engine).

(b) Do a check of the engine oil for total acid number (TAN), water content (WC), and kinematic viscosity (KV). Refer to SB 238 and the JT8D Oil Monitoring Guide, Sections B and C. Refer to ASTM D6304-00 for WC, 800 PPM maximum allowed.

1 If the TAN, KV, and WC are satisfactory, go on to the subsequent step.

2 If the TAN, KV, and WC are not satisfactory, it is necessary to change the oil before the engine run specified below. Go on to the subsequent step.

(c) Remove the front accessory drive group. Refer to Task 72-21-00-300-002, (Section 72-21-00, Maintenance Practices-00) and carefully examine the inside of the assembly and the inside of the No. 1 bearing compartment for indications of corrosion.

1 If there is no corrosion, install the front accessory drive group. Refer to Task 72-21-00-300-002, (Section 72-21-00, Maintenance Practices-00.

2 If there is corrosion, disassemble the engine for visual inspection of all main shaft bearings, bearing compartments, and bearing stack/compartment detail parts for corrosion (refer to the Standard Practices Section and the applicable Engine Manual section). Also examine the interior of the oil tank and gearbox for corrosion. Do all corrective actions as necessary.

(d) Remove the No. 6 bearing oil pump assembly (to make it possible to examine the No. 6 bearing compartment). Refer to Chapter/Section 72-50-00, Maintenance Practices-00 (Task 72-50-00-440-001). Examine the compartment for indications of corrosion.

1 If there is no corrosion, install the No. 6 bearing oil pump. Refer to Chapter/Section 72-50-00, Maintenance Practices-00 (Task 72-50-00-440-001).

2 If there is corrosion, disassemble the engine for visual inspection of all main shaft bearings, bearing compartments, and bearing stack/compartment detail parts for corrosion (refer to the Standard Practices Section and the applicable Engine Manual section). Also examine the interior of the oil tank and gearbox for corrosion. Do all corrective actions as necessary.

(e) Do an engine run to part power and do an oil leak check.

1 If there are no leaks, the engine can go back to service with one final check after 50 hours (see the subsequent step).

2 If oil leaks are found, identify and correct the leaks. Do the part power engine run and oil leak check again.

(f) After 50 hours of operation, do a SOAP analysis of an oil sample. It is specially important to do an analysis for high iron (fe) content. Refer to the JT8D Oil Monitoring Guide, Section G. Also do an inspection of the main oil filter/strainer and magnetic chip detectors for contamination.

NOTE: High iron content can be an indication of main bearing distress.

1 If the oil analysis is not satisfactory, do the corrective action (engine disassembly).

2 If the oil analysis is satisfactory, no more actions are necessary.

(2) Fuel System Depreservation

NOTE: These procedure are necessary if the 28 - 90 day (fuel system) preservation procedure was not done and the engine storage or inactivity period was more than 28 days.

(a) Before an engine run, get a fuel sample from the fuel control or fuel pump (approximately one quart or one liter is necessary). Make sure that no water is seen (refer to ASTM D4176 (Procedure 1) Visual Inspection method). Also make sure that the fuel is clear and bright by visual inspection.

1 If the fuel sample is satisfactory, go on to the subsequent step.

2 If the fuel sample is not clear and bright or if water is found (or if a fuel sample was not available for test), replace (or disassemble and examine) the fuel pump, fuel heater, fuel control, oil cooler, and pressurizing and dump valve.

(b) Do an engine run at part power and do a fuel leak check.

1 If there are no leaks, go on to the subsequent step.

2 If fuel leaks are found, identify and correct all leaks. Do the part power engine run and leak check again.

(c) If fuel system components were not replaced, examine the fuel filters and screens for contamination.

1 If contamination is found, clean the filters and screens. Do the engine run and filter and screen check again. If material is found after the second engine run, replace all fuel system components.

2 If the filters and screens are clean, no more actions are necessary, and the engine can go back into service.

(3) Engine External Inspection

NOTE: These procedures are necessary if there was not a tight cover on the engine.

(a) Examine all probes, pressure ratio bleed control vents, and air signal lines (Ps3 strainer also) for possible blockage (for example insect or bird nests).

(b) Do a part power engine run and do a fuel and oil leak check.

(c) Do a check of anti-surge bleed operation. Refer to Troubleshooting-04 (Task 72-00-00-810-006).

(4) Rear Compressor Inspection

(a) Make sure that all rear compressor disks (stages 7 thru 12) are in compliance with ASB 6431 (this ASB makes corrosion inspection of disks necessary).

NOTE: As specified in the ASB, engine storage does not add Years Since New/Re-Coat (YRSNRC) to rear compressor disks, but only if the engine is correctly preserved and stored immediately after new or overhauled disks are installed. Engine preservation by the specified 7 - 28 day (gaspath) procedure is satisfactory for this.

Task 72-00-00-610-004:

4. Identification of Engine and Engine-to-Aircraft Connections for Instrumentation, Fuel, and Oil

A. The JT8D engines are permanently marked to identify the engine-to-aircraft connections for instrumentation, fuel, and oil. Where the marking location has suitable area, the "Identification Marking" is used, otherwise the "Location Code" marking is used. See Figure 301 and Figure 302 and Table 301.

LOCATION CODE	BASIC NOMENCLATURE	IDENTIFICATION MARKING
	FUEL DRAIN	
FD1	Combustion Chamber Fuel Drain, Front and Rear	FUEL DRAIN 1
FD3	Fuel Filter Drain	FUEL DRAIN 3
FD4	Dump Valve Fuel Drain	FUEL DRAIN 4
FD6	Fuel Pump Seal Drain	FUEL DRAIN 6
	FUEL FLOW	
F1	Fuel Pump Main Supply Inlet	FUEL IN 1
F2	Fuel Flowmeter Supply Inlet	FUEL IN 2
F3	Fuel Flowmeter Supply Outlet	FUEL OUT 3
F5	Fuel Filter Supply Inlet	FUEL IN 5
	FUEL PRESSURE	
FP1	Fuel Pump Inlet Pressure	FUEL PRESS 1
FP3	Fuel Pump Outlet Pressure	FUEL PRESS 3
FP4	Pressurizing Valve Primary Fuel Pressure	FUEL PRESS 4
FP5	Pressurizing Valve Secondary Fuel Pressure	FUEL PRESS 5
FP6	Fuel Filter Pressure	FUEL PRESS 6
FP16	Fuel Pump Inlet Pressure Return	FUEL PRESS 16
	FUEL TEMPERATURE	
FT1	Heater Outlet Fuel Temperature	FUEL TEMP 1
FT3	Fuel Pump Inlet Temperature	FUEL TEMP 3
	FUEL VENT	
FV2	Fuel Pump Vent Outlet	FUEL VENT 2
	OIL BREATHER	
LB2	Overboard Breather Pad	OIL BREATHER 2
	OIL DRAIN	

Identification Marking For Engine
And Engine-To-Aircraft Connections
For Instrumentation, Fuel, And Oil
Table 301

LOCATION CODE	BASIC NOMENCLATURE	IDENTIFICATION MARKING
LD1	Oil Tank Drain	OIL DRAIN 1
LD2	Oil Tank Overflow Drain Outlet	OIL DRAIN 2
LD3	Oil Cap Overflow Drain	OIL DRAIN 3
LD4	Gearbox Main Oil Drain	OIL DRAIN 4
LD5,6, 7,8	Accessory Drive Overboard Drain	OIL DRAIN 5,6, 7,8
LD13	Main Oil Filter/Strainer Drain	OIL DRAIN 13
	OIL FLOW	
L1	Oil Tank Remote Filler Inlet	OIL IN 1
	OIL LEVEL	
LL1	Oil Tank Indicator	OIL LEVEL 1
LL3	Oil Tank Sight Gage Boss	OIL LEVEL 3
	OIL PRESSURE	
LP3	Gearbox Low Pressure Warning	OIL PRESS 3
LP5	Oil Filter Inlet Pressure	OIL PRESS 5
LP6	Oil Filter Outlet Pressure	OIL PRESS 6
	OIL TEMPERATURE	
LT1	Oil Temperature Bulb	OIL TEMP 1
LT3	Oil Temperature Cooler	OIL TEMP 3
	OIL VENT	
LV3	Gearbox Transmitter Oil Vent	OIL VENT 3
	TEMPERATURE SENSING	
IT7	Turbine Exit Temperature (Average)	TURB DISCH AVG TEMP
ITT7	Turbine Exit Temperature (Individual)	TURB DISCH TEMP
	PRESSURE SENSING	

Identification Marking For Engine
And Engine-To-Aircraft Connections
For Instrumentation, Fuel, And Oil
Table 301 (Continued)

LOCATION CODE	BASIC NOMENCLATURE	IDENTIFICATION MARKING
PT2	Compressor Inlet Pressure	COMPR IN PRESS 2
PT7	Turbine Exit Pressure	TURB DISCH AVG PRESS

Identification Marking For Engine
And Engine-To-Aircraft Connections
For Instrumentation, Fuel, And Oil
Table 301 (Continued)

Task 72-00-00-610-005:

5. Spare Engine Transportation and Storage

A. Transportation and Storage

(1) A spare engine may be transported in an external pod or in a cargo compartment of an aircraft. In either case, protect engine from corrosion, especially if humid conditions are expected to be encountered enroute to destination.

CAUTION: WHEN INSTALLING ENGINE IN EXTERNAL POD OR CARGO COMPARTMENT OF AN AIRCRAFT, DO NOT USE NYLON SELF-LOCKING NUTS ON ENGINE MOUNT SHIPPING BOLTS SINCE LOSS OF TORQUE CAUSING ENGINE/BOLT MOVEMENT MAY RESULT.

(2) Preserve engine and oil systems as directed in Preservation/Depreservation of Engine.

NOTE: In addition to following regular preservation procedures, the following may be done for engines which are enroute to overhaul.

CAUTION: ENGINES WHICH HAVE BEEN SPRAYED WITH OIL INTERNALLY ARE NOT TO BE RUN UNTIL COMPLETELY DISASSEMBLED AND CLEANED.

(a) Use a fine spray to apply a thin film of oil on parts of engine.

(b) Direct spray into exhaust area only.

(3) Install fifty-two pounds of desiccant or dehydrating agent, half in the inlet and half in the exhaust section of the engine. Be sure desiccant is properly packaged and secured.

(4) Install and secure a humidity indicator in the inlet and exhaust ends of engine.

(5) Install appropriate external pod fairings and covers to act as moisture barriers and prevent air circulation through the engine.

(6) Engines shipped in cargo compartments shall be wrapped in a nearly air tight suitable plastic type envelope or sealed by covers at the inlet and exhaust openings.

(7) Upon arrival at destination and removal of engine from air- craft, remove fairings, covers, humidity indicators and dehydrating agent. Check humidity indicators before removal.

(8) Blow hot dry air through engine to remove moisture before continued storage. Hot air velocity shall not be great enough to cause engine rotation.

NOTE: If engine is to be installed in an aircraft and run immediately the drying process is not required.

(9) Continued storage shall follow established procedures.

Task 72-00-00-610-006:

6. Transporting Engine With "Two Engine Ferry" Method

A. Procedure

NOTE: The "two engine ferry" procedure is for three engine aircraft (Boeing 727). Do this procedure if one of the three engines is not operational and a flight is necessary to move the aircraft for repairs.

CAUTION: THE COMPRESSOR ROTORS MUST NOT TURN IF THE ENGINE IS NOT OPERATED DURING A FLIGHT. AIR WHICH GOES THROUGH THE ENGINE DURING A FLIGHT

WILL CAUSE THE COMPRESSOR ROTORS TO TURN AND DAMAGE TO THE BEARINGS WILL OCCUR.

(1) Use a PWA 46048 Strap Kit to hold the fan rotor as follows:

NOTE: Use a PWA 47907 Strap Kit on engines with the re-spaced inlet (RIGV) modification (post SB 5947).

CAUTION: DO NOT USE STRAPS THAT ARE WORN OR DAMAGED. WORN OR DAMAGED STRAPS CAN BREAK AND PERMIT THE LOW PRESSURE COMPRESSOR ROTORS TO TURN.

(a) Install a protective pad under each buckle and attach a cable tie strap on the side of the buckle opposite the feed side. Refer to Figure 303.

(b) Install a strap at approximately the 6:00 (six o'clock) position. See Figure 304.

NOTE: Install all straps inboard of the span shroud. Do not twist the straps during installation.

1 Pull the strap between the inlet guide vanes and between the 1st stage fan blades as shown in Figure 304. Pull the strap between 6 vanes (one after the other) and across a distance of 8 blades. Attach the strap to 7 of the 8 blades.

2 Pull the strap until it is tight.

R (c) Install the 2 remaining straps as shown in Figure
R 304. Refer to the schematic in the figure to pull
R the straps between the correct vanes and blades.

(d) Pull all the straps until they are tight.

NOTE: Each strap is approximately 16.000 inches (406.400 mm) longer than what is necessary to hold the 1st stage compressor rotor.

(e) Install the buckle lock bolts as shown in Figure 303. Torque the nuts to 200 - 225 lb-in. (22.597 - 25.422 N.m).

(f) Hold the loose end of the strap with cable tie straps (see Figure 303).

(2) Lock the N2 rotor with PWA 46052 Lock.

(a) Remove the starter from the gearbox.

(b) Install PWA 46052 Lock on the starter drive pad studs. Engage the lock with the starter drivegear splines.

(c) Attach the lock to the starter drive pad with nuts.

(3) Remove the PWA 46052 Lock and the PWA 46048 or PWA 47907 (post SB 5947) Strap Kit when the "ferry" flight is completed.

Task 72-00-00-610-007:

7. Identification of Metal Particles

A. General

(1) When unidentified particles of metal are found, they must be either steel, tin, aluminum, magnesium, silver, bronze, or cadmium. In some cases the type of metal may be determined by the color and hardness of the pieces. However, when the particles cannot be positively identified by visual inspection and knowledge of the exact character of the metal is desired as an aid to troubleshooting, a few simple tests will determine the kind of metal present.

WARNING: USE EXTREME CARE IN HANDLING THE ACIDS.

(2) The following equipment and chemicals are required to make these tests: A source of open flame, a permanent magnet, two ounces of aqueous solution containing ten percent ammonium nitrate, an electric soldering iron, two ounces each of 50 percent by volume hydrochloric acid, and concentrated nitric acid, sodium hydroxide pellets, a watch glass, a white porcelain spot plate, ammonium bifluoride crystals, 5 to 10% hydrofluoric acid or concentrated sulfuric acid, 3 to 10% hydrogen peroxide, and concentrated phosphoric acid.

B. Test Procedure

(1) The following test procedure is recommended for determining the character of unknown metal particles. For best results, follow the steps as outlined:

(a) Steel - The particles can be isolated by means of the permanent magnet. Steel or iron is attracted by the magnet.

(b) Magnesium - A simple test for these particles is burning. Magnesium will burn with a bright white flash.

WARNING: NEVER ATTEMPT TO BURN MORE THAN A FEW PARTICLES OF METAL SUSPECTED TO BE MAGNESIUM. MAGNESIUM POWDER OR DUST IS EXPLOSIVE.

(c) Cadmium - Place the remaining particles in the aqueous (water) solution of ammonium nitrate. If all or any of the particles dissolve in this solution, they are cadmium. After this test, rinse and dry any remaining particles.

(d) Tin - The tin particles can be distinguished by their low melting point. With a clean soldering iron, heated to 500°F (260°C) and tinned with 50-50 solder (50 percent tin - 50 percent lead), a tin particle dropped on the iron will melt and fuse with the solder.

WARNING: HYDROCHLORIC ACID IS DANGEROUS AND REQUIRES SPECIAL HANDLING.

(e) Aluminum - When a particle of aluminum is placed in hydrochloric acid 50 percent by volume, it will fizz with rapid emission of gas bubbles and gradually disintegrate and form a black residue (aluminum chloride). Silver and bronze do not noticeably react with hydrochloric acid.

(f) Aluminum Paint - Use this procedure to determine whether or not the material is aluminum silicone paint, aluminum chips, or silver particles.

1 Make a sodium hydroxide solution by adding one pellet of sodium hydroxide to three cubic centimeters of water.

2 Place several drops of this solution in a watch glass and drop in the suspected particles.

3 If the particles are aluminum silicone paint, there will be a mild reaction in the form of gas bubbles and some visible gas as the particles change to sodium aluminate.

4 If the particles are aluminum chips, the reaction will be much more active with many more gas bubbles forming and more visible gas.

5 If the particles are silver, there will be no reaction.

(g) Silver - When a silver particle is placed in nitric acid, it reacts rather slowly, producing a whitish fog in the acid.

(h) Bronze - When a bronze (or copper) particle is placed in nitric acid, a bright green cloud is produced.

C. Test Procedure for Titanium

(1) Place a piece or pieces of the metal to be identified on a white porcelain spot plate. A piece of titanium or titanium bearing metal should be placed on another spot plate to observe and verify the results obtained.

(2) Add several crystals of ammonium bifluoride and 5 - 10 drops of water to the metal particles. (2 - 3 drops of a 5 - 10% hydrofluoric acid solution can be used instead.)

(3) Let stand 20 - 30 minutes, or until the solution becomes slightly discolored.

(4) Add 2 - 3 drops of 1:1 sulfuric acid (1 part water to 1 part concentrated acid).

(5) Let stand 20 - 30 minutes, or until solution becomes more discolored.

(6) Add 3 - 4 drops of 3 - 10% hydrogen peroxide. Solution must not be too old.

(7) If titanium is present a yellowish color will develop. This yellow color will become progressively darker with time, if allowed to set.

(8) Add 2 - 3 drops of concentrated phosphoric acid, and stir to discharge any yellow color due to the possible presence of iron.

(9) Any light yellow to orange color indicates the presence of titanium.

NOTE: Above chemicals are hazardous and require special handling. Solid ammonium bifluoride is crystalline and can be conveniently stored in a dry place and used as needed.

D. Gear And Bearing Material Identification. See Tables 302 thru 305.

(1) If it is not known where a chip in the oil system comes from, use spectrographic analysis to find the material.

(2) Tables 302 thru 305 show what percent of a gear or bearing part is a given material (it is possible to find small particles or chips of these engine parts in oil).

	Gear Material	Bearing Material	
	AMS 6260 Min - Max	PWA 723 Min - Max	PWA 725 Min - Max
Carbon	0.07 - 0.13	0.95 - 1.10	0.77 - 0.85
Manganese	0.40 - 0.70	0.25 - 0.45	-- 0.35
Silicon	0.20 - 0.35	0.20 - 0.35	-- 0.25
Phosphorus	-- 0.025	-- 0.025	-- 0.015
Sulfur	-- 0.025	-- 0.025	-- 0.015
Chromium	1.00 - 1.40	1.30 - 1.60	3.75 - 4.25
Nickel	3.00 - 3.50	-- 0.15	-- 0.15
Molybdenum	0.08 - 0.15	-- 0.10	4.00 - 4.50
Copper	-- 0.35	-- 0.15	-- 0.15
Vanadium	-- --	-- --	0.90 - 1.10
Cobalt	-- --	-- --	-- 0.25
Tungsten	-- --	-- --	-- 0.25
Iron	Remainder	Remainder	Remainder

Table 302

Bearing Material

	AMS 724 Min - Max	AMS 6440 Min - Max	AMS 6441 Min - Max
Carbon	0.10 - 0.15	0.98 - 1.10	0.98 - 1.10
Manganese	0.40 - 0.60	0.25 - 0.45	0.25 - 0.45
Silicon	0.20 - 0.35	0.15 - 0.35	0.15 - 0.35
Phosphorus	-- 0.025	-- 0.025	-- 0.025
Sulfur	-- 0.025	-- 0.025	-- 0.025
Chromium	1.35 - 1.75	1.30 - 1.60	1.30 - 1.60
Nickel	2.60 - 3.00	-- 0.25	-- 0.25
Molybdenum	4.80 - 5.20	-- 0.10	-- 0.10
Copper	-- 0.35	-- 0.35	-- 0.35

Table 303

	Gear Material	Bearing Material	
	AMS 6265 Min - Max	AMS 6274 Min - Max	AMS 6414 Min - Max
Carbon	0.07 - 0.13	0.17 - 0.23	0.38 - 0.43
Manganese	0.40 - 0.70	0.60 - 0.95	0.60 - 0.90
Silicon	0.15 - 0.35	0.15 - 0.35	0.15 - 0.35
Phosphorus	-- 0.015	-- 0.025	-- 0.015
Sulfur	-- 0.015	-- 0.025	-- 0.015
Chromium	1.00 - 1.40	0.35 - 0.65	0.70 - 0.90
Nickel	3.00 - 3.50	0.35 - 0.75	1.65 - 2.00
Molybdenum	0.08 - 0.15	0.15 - 0.25	0.20 - 0.30
Copper	-- 0.35	-- 0.35	-- 0.35

Table 304

Bearing Material

	AMS 4616 Min - Max	AMS 6294 Min - Max	AMS 6490 Min - Max
Copper	90.00 --	-- 0.35	-- 0.10
Manganese	-- 1.00	0.45 - 0.65	-- 0.35
Silicon	2.40 - 4.00	0.15 - 0.35	-- 0.25
Phosphorus	-- 0.10	-- 0.025	-- 0.015
Carbon	-- --	0.17 - 0.22	0.77 - 0.85
Sulfur	-- --	-- 0.025	-- 0.015
Nickel	-- --	1.65 - 2.00	-- 0.15
Molybdenum	-- --	0.20 - 0.30	4.00 - 4.50
Chromium	-- --	-- 0.20	3.75 - 4.25
Vanadium	-- --	-- --	0.90 - 1.10

Table 305

Bearing Material

	AMS 4616 Min - Max		AMS 6294 Min - Max		AMS 6490 Min - Max	
(CONTINUED)						
Cobalt	--	--	--	--	--	0.25
Tungsten	--	--	--	--	--	0.25
Zinc	1.50 - 4.00		--	--	--	--
Iron	1.00 - 2.00		--	--	--	--
Total Named Elements	99.50	--	--	--	--	--

Refer to the JT8D Oil Monitoring Guide, Part No. 821432 for more information on the identification of oil wetted parts.

Table 305 (Continued)

Task 72-00-00-610-008:

8. Fuel

A. General

(1) The fuel for the JT8D engine shall conform to PWA 522 specifications. See SB 2016.

(2) Fuel contamination may occur in shipment, during transfer from one container to another, or in the aircraft fuel system from scale, lint from packings and seals, and deterioration of fuel lines and hoses. Serious malfunction of the engine will occur, even to the extent of engine stoppage, as a result of contaminants in the fuel reaching the engine fuel system. It is important, that the filter screens in the aircraft fuel system upstream of the engine fuel pump be inspected periodically for removal of all foreign particles.

Task 72-00-00-610-009:

9. Fuel Tanks (See Airframe Service Instructions)

Task 72-00-00-610-010:

10. Lubricating Oil

A. General

(1) The oil for the JT8D engine shall conform to PWA 521 specifications. See SB 238.

(2) The engine internal oil system is shown schematically in Engine - Description.

B. Fuel Contamination Of Oil System

(1) Failure within the fuel-oil cooler can cause contamination of the oil system with fuel. Depending upon the degree of contamination, certain procedures are required.

(2) Upon discovering fuel contamination of the oil system and correcting its cause, the following basic procedures must be performed.

(a) Drain oil (see Inspection/Check) and fill the oil tank to 2/3 capacity with new oil.

(b) Operate engine at Idle (see Adjustment/Test) for two-five minutes and shut down.

(c) Drain oil and fill oil system to full capacity with new oil.

(d) Following the next flight, inspect main oil filter or strainer (see Inspection/Check).

(e) Repeat main oil filter or strainer inspections at 25, 50 and 75 hours thereafter. If there is no evidence of loosened carbon deposits at the 75-hour inspection, resume normal filter or strainer check interval.

(3) The following dilution levels and engine operating limits apply:

NOTE: The percentage of fuel in the oil is best determined by laboratory analysis to determine the viscosity. See the curve shown in Figure 305 for viscosity vs. temperature to determine the percentage of dilution (of fuel in the oil).

NOTE: As an alternate, if laboratory analysis is not available, specific gravity methods with a density meter or hydrometer are considered suitable to approximate the percentage of dilution. See Figure 306.

NOTE: Specific gravity methods are only accurate above the 25 percent level. The viscosity method is the preferred method to be used.

Percentage Of Dilution	Permissible Engine Operating Time (While Contaminated)
Up to 10 percent	Unlimited
10 - 25 percent	Up to 10 hours
25 - 50 percent	Up to 2 hours
Above 50 percent	Momentary (provided maximum thrust was not used)

(a) If an engine exceeds operating time limits specified for the degree of contamination found, it must be removed and routed to a maintenance facility for disassembly and inspection of all main bearings.

(b) If an engine's operating time while contaminated was within limits given, only oil system flushing and main oil filter or strainer checks described in step (2) are required.

C. Hydraulic Fluid Contamination Of Oil System

CAUTION: CONTAMINATION OF OIL WITH HYDRAULIC FLUID IS SERIOUS. AT ENGINE OPERATING TEMPERATURE HYDRAULIC FLUID REACTS WITH SYNTHETIC OILS TO FORM THICK, BLACK GUMMY SUBSTANCE WHICH COULD BLOCK OR DRASTICALLY RESTRICT OIL FLOW THROUGH JETS, NOZZLES, OR FINE MESH SCREENS. DEPENDING UPON AMOUNT AND DURATION OF CONTAMINATION AND OPERATING TEMPERATURE, HYDRAULIC FLUID MAY REACT CHEMICALLY WITH PREFORMED PACKINGS, REMOVE PROTECTIVE COATINGS FROM GEARBOX HOUSING INTERNAL

SURFACES, AND CAUSE LEAKS AND CORROSION OF OIL SYSTEM PARTS.

(1) If contamination of oil by hydraulic fluid (or jet fuel) is suspected or confirmed, perform the following.

NOTE: Hydraulic fluid may be introduced into oil system by leaks (i.e. as a result of hydraulic pump failure) or by inadvertently adding hydraulic fluid to oil tank during servicing.

(a) Drain oil tank, flush and refill with new oil.

(b) Drain gearbox of any residual oil.

(c) Replace oil filter or strainer.

(d) Operate engine at idle to warm oil, accelerate to part power and return to idle five times, run at part power for 20 minutes, and shut down.

(e) Take oil sample and analyze for contamination.

1 If oil shows contamination during this analysis, repeat steps (a) through (e).

NOTE: Engine may be continued in service while oil sample is being analyzed.

2 Sample exhibiting viscosity appreciably different from that of sample of same brand of oil which is known to be uncontaminated is indicating contamination with either jet fuel or hydraulic fluid.

3 Contamination of oil with hydraulic fluid can best be detected by measuring phosphorus content, either by wet chemical test (ASTM-D-1091-64) or by spectrographic oil analysis. Phosphorous content higher than that of same brand of oil which is known to be uncontaminated indicates contamination by hydraulic fluid.

Task 72-00-00-610-011:

11. Extreme Weather Maintenance

A. Cold Weather Procedures

(1) General

(a) A discourse on the effects of cold weather upon turbofan engine operation is not the purpose of this publication; however, it is felt that a summary of a few of the more prevalent effects will aid in troubleshooting some of the problems arising from cold weather operations.

(b) Aviation fuels will normally contain little or no water, but the percentage of water is governed to a great extent by storage and handling conditions of the fuel. Fuel exposed to dampness or ordinary atmospheric conditions naturally contain a larger percentage of water than those kept in tightly sealed containers. This water content, under poor conditions, may average as high as several gallons in every thousand gallons of fuel.

(c) As temperatures are reduced, the solubility of water in the fuel is also markedly reduced, which results in the water separating from the fuel, seeking the lowest point in the tank, system, and/or accessory concerned and freezing there if the temperature goes low enough. Under these conditions it also will freeze in the fuel, forming tiny needle-shaped crystals which may be found impinged on the strainers, restricting fuel flow and in severe cases clogging the strainers entirely. Should this condition occur it will be evidenced by a drop in, or loss of fuel pressure to the engine. The only remedy is hot air applied to the engine and fuel system components. Refer to airframe manufacturer's recommendations for externally applied heat.

(d) Under these conditions, it is most important that all sumps, strainers, traps (burner pressure sensing line moisture trap) and filters be thoroughly inspected on all preflight checks. As long as fuel will flow freely from the drain cocks in the tank sumps and strainers it can be surmised that the system is free of ice.

(e) In the event that water has collected and frozen in the sumps and/or strainers (indicated by a lack of flow from the drain cock) heat should be applied in accordance with the airframe manufacturers recommendations.

CAUTION: DO NOT ASSUME THAT ALL THE ICE HAS MELTED IF IT IS POSSIBLE TO DRAIN FUEL FROM THE DRAIN COCK AFTER SEVERAL MINUTES OF HEATED AIR APPLIED TO THE EXTERIOR OF THE AFFECTED COMPONENT. THE ICE ADJACENT TO THE INTERIOR OF THE AFFECTED UNIT MAY MELT AND ALLOW SOME WATER AND FUEL TO FLOW FROM THE DRAIN, BUT A LUMP OF ICE MAY STILL REMAIN IN THE FUEL CREATING A SERIOUS HAZARD TO ANY FLIGHT OPERATION. THE FLOW OF FUEL TO THE OUTLET, ON ENGINE STARTING MAY CAUSE THIS BLOCK OF ICE TO SLIP OVER THE OUTLET AND RESTRICT OR PLUG THE OPENINGS CREATING A DANGEROUS SITUATION. IF FUEL DOES FLOW FROM THE DRAIN COCK, CONTINUE TO APPLY HEATED AIR FOR A SHORT TIME, CHECKING THE DRAIN COCK FLOW FREQUENTLY. THIS FUEL SHOULD BE CAUGHT IN A CONTAINER AND INSPECTED FOR GLOBULES OF WATER UNTIL IT IS EVIDENT THAT IT IS ALL REMOVED FROM THE AREA.

(f) It is well to note that a similar situation may exist in the lubrication system, with the water coming from condensation of air in the tank or engine case area. When a hot engine is shut down under low temperature conditions and allowed to stand for a period of time or possibly over night in the open, the possibility of ice in the fuel and lubrication system is much more prevalent. Extra precautions should be observed to prevent this condition and the system should be checked for the presence of ice on the preflight.

CAUTION: WHEN STARTING AN ENGINE WHICH HAS BEEN EXPOSED TO LOW TEMPERATURES OVER NIGHT, CAREFULLY OBSERVE THE FUEL AND OIL PRESSURES. THE LACK OF ANY INDICATION BELOW THE NORMAL OPERATING LIMITS IS CAUSE FOR IMMEDIATE ENGINE SHUTDOWN. INSPECT FOR ICE IN THE SYSTEM(S) OR MOVE THE PLANE INDOORS AND/OR

APPLY HEATED AIR BEFORE ATTEMPTING ANOTHER START.

(2) Additional Preflight Inspection

(a) Examine the engine exhaust section for the collection of ice. Rotational freedom of the rear turbine should be verified.

(3) Starting Engine

(a) Start the engine using the normal starting procedure.

CAUTION: IF THERE IS NO INDICATION OF OIL PRESSURE AFTER 30 SECONDS OF ENGINE OPERATION, OR IF THE PRESSURE DROPS TO ZERO AFTER A FEW MINUTES OF GROUND RUNNING, STOP THE ENGINE AND INVESTIGATE.

(b) Although not absolutely necessary, it is desirable when a start is made during extreme cold weather with an engine which has cold soaked to a temperature of -30° F (-35° C) or below to warm up the engine for two minutes before advancing the power lever above IDLE rpm.

NOTE: It should be noted that engine thrust developed at low ambient temperatures is higher than that developed at standard day conditions at comparable power lever settings.

(4) Engine Shutdown

(a) Shutdown engine in the normal manner.

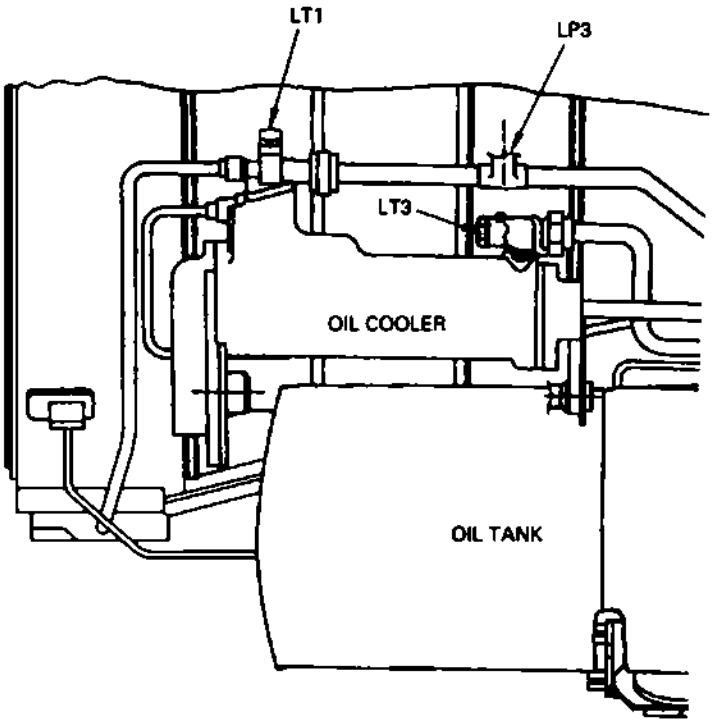
B. Hot Weather Procedures

(1) Starting Engine

(a) Normal starting procedures are used in hot weather. Temperatures will probably be on the high side of operating ranges.

(2) Warm-up and Ground Test

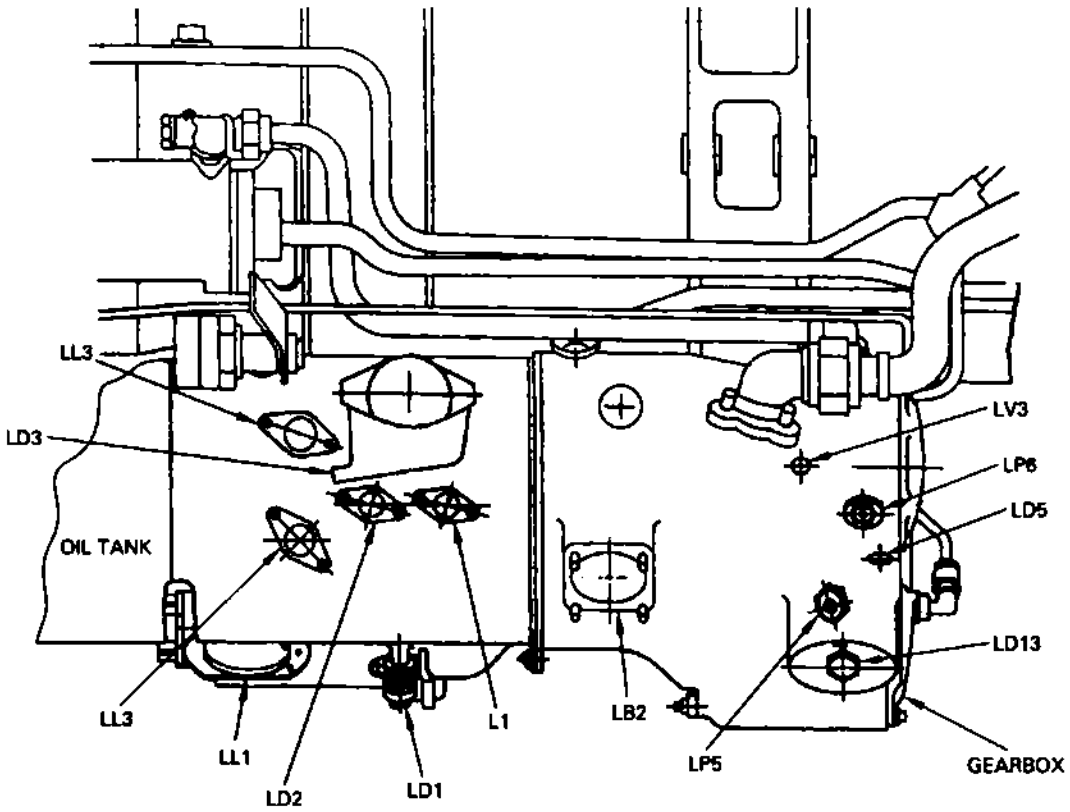
(a) Ground testing should be complete but accomplished as rapidly as possible.



ENGINE LEFT SIDE (FRONT)

L-H6783 (0504)

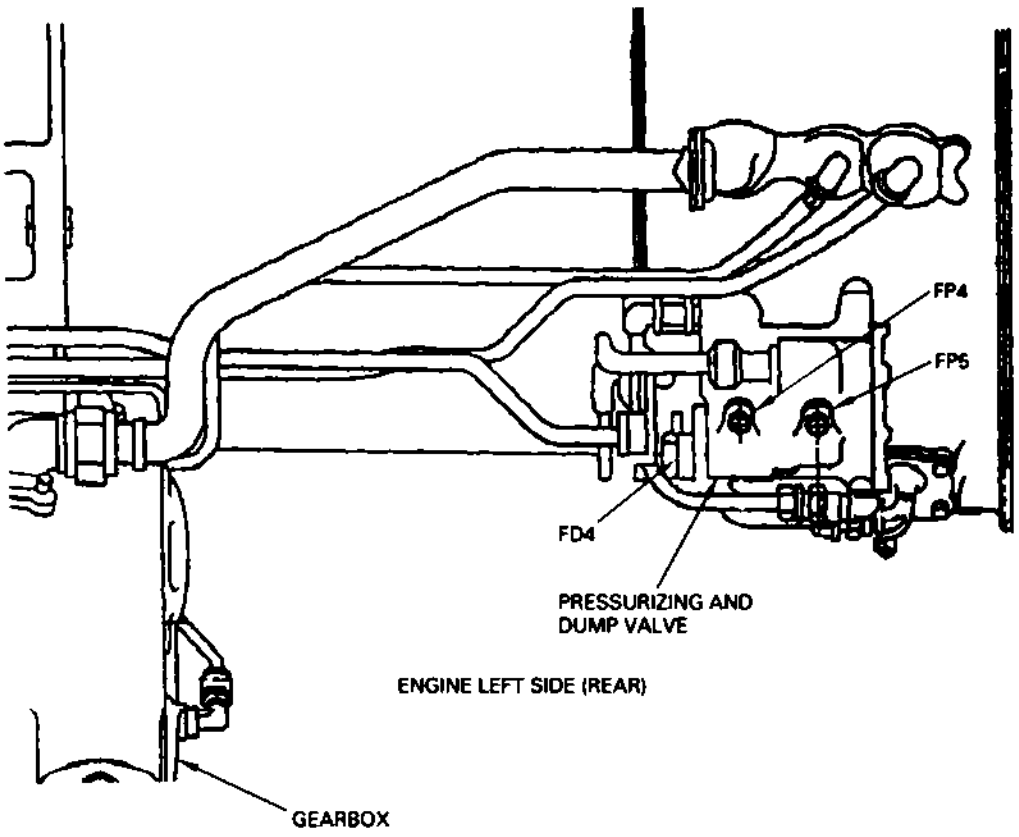
Engine Test/Instrumentation
Connections (Left Side)
Figure 301 (Sheet 1)
(Task 72-00-00-610-011)



ENGINE LEFT SIDE (CENTER)

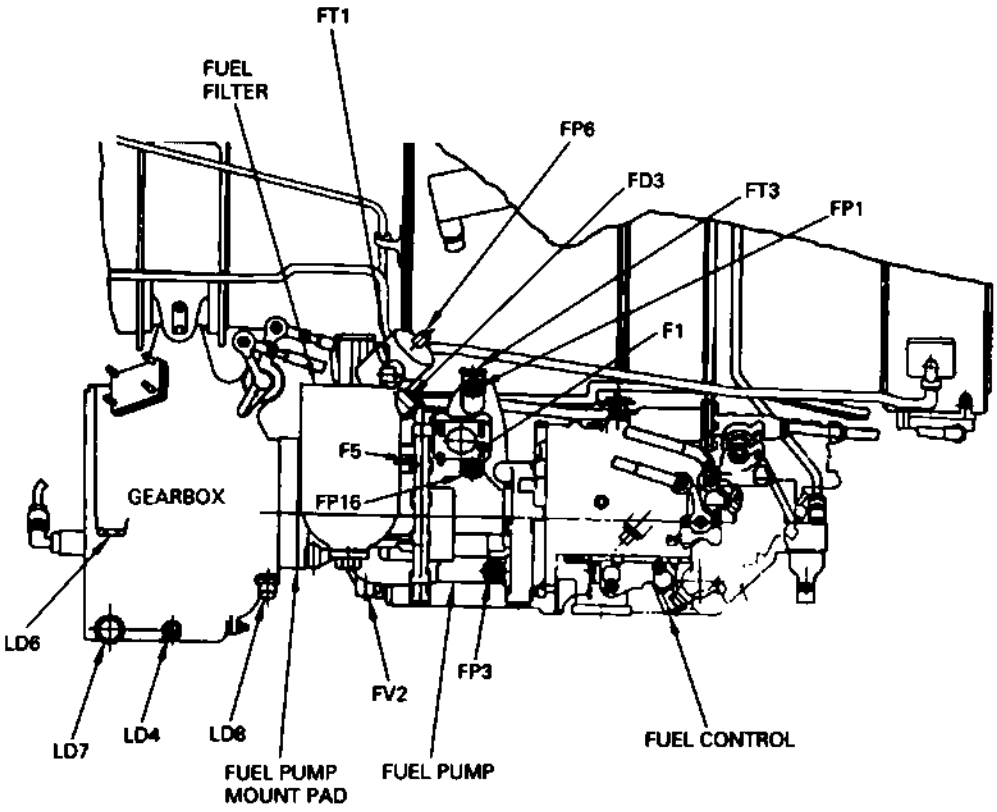
L-H6784 (0504)

Engine Test/Instrumentation
Connections (Left Side)
Figure 301 (Sheet 2)
(Task 72-00-00-610-011)



L-H6786 (0504)

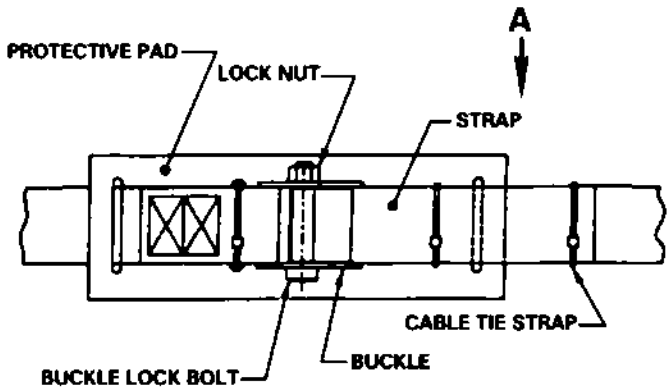
Engine Test/Instrumentation
Connections (Left Side)
Figure 301 (Sheet 3)
(Task 72-00-00-610-011)

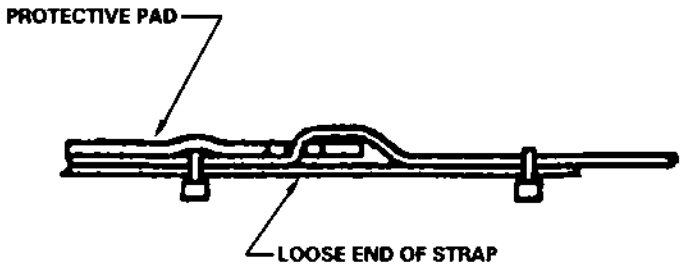


ENGINE RIGHT SIDE (CENTER)

L-H6785 (0504)

Engine Test/Instrumentation
Connections (Right Side)
Figure 302
(Task 72-00-00-610-011)

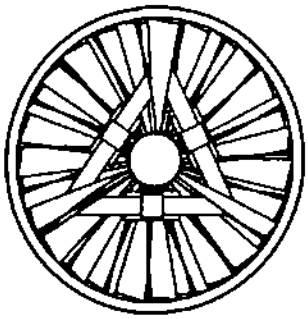




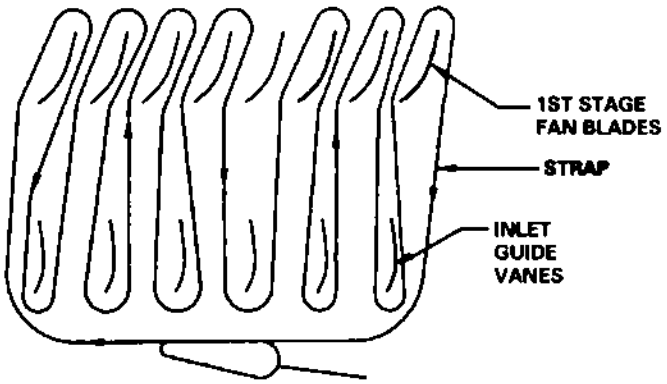
VIEW IN DIRECTION A

L-H1951 (0000)

Strap Kit Components
Figure 303
(Task 72-00-00-610-011)



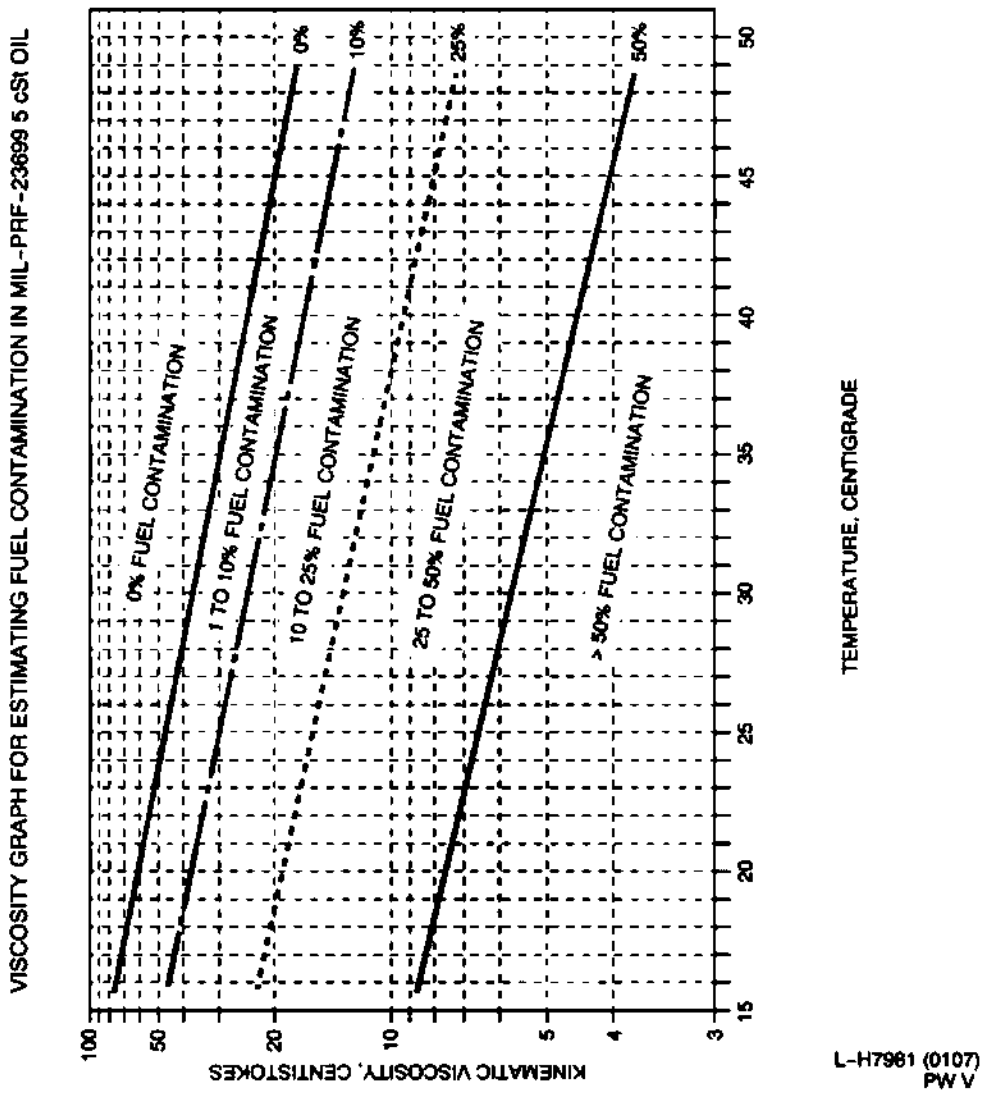
VIEW OF ENGINE INLET



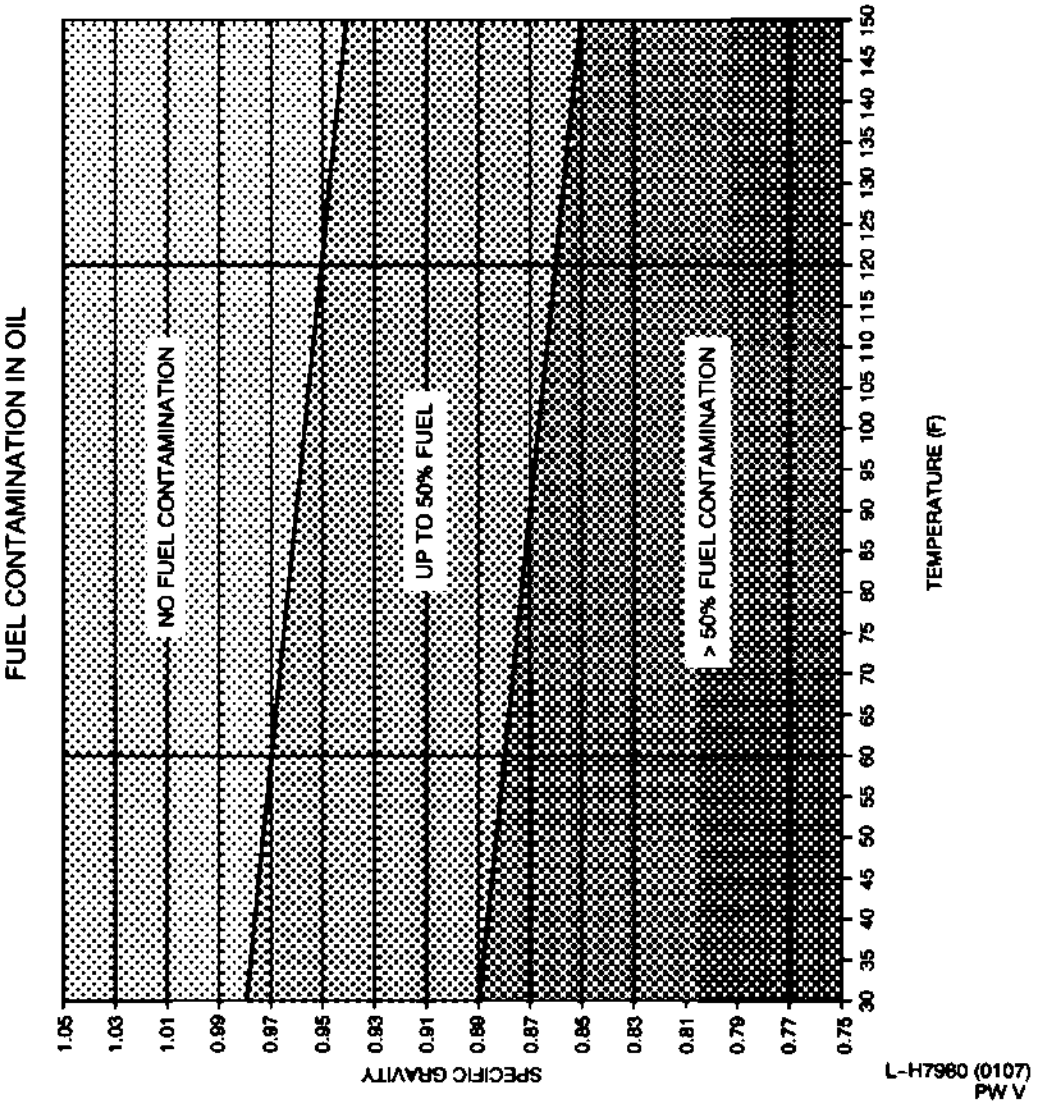
STRAP INSTALLATION

L-H1953 (0000)

Strap Kit Installation
Figure 304
(Task 72-00-00-610-011)



Fuel Contamination In Oil
Graph - Laboratory Method
Figure 305
(Task 72-00-00-610-011)



Fuel Contamination In Oil
- Specific Gravity Method
Figure 306
(Task 72-00-00-610-011)

Task 72-00-00-020-001:

1. General

A. Engine Disassembly Procedures

CAUTION: THIS ENGINE INCORPORATES LABYRINTH SEALS AT SEVERAL BEARING COMPARTMENTS INCLUDING THE NO. 4, AS RESIDUAL OIL EXISTS IN THIS COMPARTMENT AFTER ENGINE SHUTDOWN, ENGINE DISASSEMBLY (EXCEPT COMPLETE DISASSEMBLY) MUST BE DONE IN A HORIZONTAL POSITION IN ORDER TO PREVENT THIS OIL FROM SPILLING PAST THE NO. 4 SEAL AND SATURATING THE HIGH COMPRESSOR ROTOR.

CAUTION: AFTER REMOVAL OF ENGINE FROM AIRCRAFT DO NOT USE NYLON SELF-LOCKING NUTS ON ENGINE MOUNT SHIPPING BOLTS SINCE LOSS OF TORQUE CAUSING ENGINE/BOLT MOVEMENT MAY RESULT.

(1) When installing or removing engine from aircraft, in order to reduce possibility of getting oil in compressor, do not tilt engine more than 20 degrees below or above fore and aft horizontal center line or do not rotate more than 30 degrees above or below a horizontal outer line at right angles to fore and aft axis. This applies when oil is present in gearbox but is not of concern during normal assembly to service of oil tank or during disassembly for overhaul.

B. Engine Tools And Fixtures

CAUTION: DO NOT CONTACT TITANIUM ENGINE PARTS WITH CADMIUM-PLATED PARTS, TOOLS, OR FIXTURES. SUCH CONTACT CAN CAUSE EMBRITTLEMENT OF TITANIUM.

CAUTION: WHEN USING PWA 12042, PRIOR TO CHANGE LETTER "F", AND LIFTING ENGINE WITH SLINGS UTILIZING VARIOUS GROUND HANDLING POINTS FOR SUPPORT AND/OR FOR LIFTING PURPOSES, UNDER-SLING ENGINE WITH TWO PLY, TWO INCH WIDE NYLON WEB SAFETY BELTS (33,600 POUNDS CAPACITY) AT COMPRESSOR INTERMEDIATE AND TURBINE EXHAUST CASES. LOCALLY ATTACH AND ADJUST BELTS TO LIFTING SLING WITH TURNBUCKLES UNTIL SUITABLY TIGHTENED. PWA 12042F (AND SUBSEQUENT CHANGE LETTER) OR PWA 33824 SLING DOES NOT REQUIRE BELTS.

C. Numerical Tool List

PWA 12042 Engine Lifting Sling (Replaced By PWA 33824)
PWA 33824 Engine Lifting Sling (Replaces PWA 12042)

Task 72-00-00-020-002:

2. Removal/Installation of Accessory Drives Gearbox. See Accessory Drives - Removal/Installation, Section 72-60-00

Task 72-00-00-020-003:

3. Fits and Clearances

A. See Inspection/Check-02

Task 72-00-00-760-001:

1. Engine Ground Safety Precautions

A. General

(1) The operating characteristics of jet engine powered aircraft have changed the ground safety picture. To prevent injury to persons and damage to property, handling and working procedures must be modified to meet new exposures. On piston engine aircraft the propeller was carefully avoided. In the case of the jet engine powered aircraft, not only must one avoid the engine intake ducts, but also the exhaust nozzle where hot, high velocity exhaust gases are discharged. Listed below are some of the general safety items which shall be supplemented according to the needs of the job, to prevent accidents.

B. The Air Intake
See Figure 501.

WARNING: THE ENGINE IS CAPABLE OF DEVELOPING ENOUGH SUCTION AT THE INLET DUCT TO PULL A MAN UP TO IT, OR PARTIALLY INTO IT, WITH POSSIBLE FATAL RESULTS. IT FOLLOWS THAT WHEN APPROACHING ANY TYPE OF JET ENGINE PRECAUTIONS MUST BE TAKEN TO KEEP CLEAR OF THE INTAKE AIR STREAM. THE SUCTION NEAR THE INTAKE CAN ALSO PULL IN HATS GLASSES, LOOSE CLOTHING AND WIPE-RAGS FROM POCKETS. ANY LOOSE ARTICLES MUST BE MADE SECURE OR REMOVED BEFORE WORKING AROUND THE ENGINE.

CAUTION: DO NOT FIELD CLEAN ENGINE BY CARBO-BLAST INGESTION METHOD.

C. Exhaust Characteristics
See Figure 501.

(1) Velocity. At high engine speeds the exhaust may pick up and blow loose dirt, sizeable stones, sand and debris a distance of several hundred feet. Therefore, due caution must be used in parking the aircraft for run-up to avoid injury to persons or damage to property or other aircraft. A blast fence is suggested if the engines are going to be run up for trim and power adjustment in an area where there is not sufficient space available for dissipation of the exhaust blast.

(2) Temperature. High temperature will be found up to several hundred feet from exhaust nozzle depending on wind conditions. Closer to engine, exhaust temperature is high enough to deteriorate bituminous pavement, therefore, concrete aprons are suggested for run-up areas. Occasionally when a jet engine is started, excess fuel that has accumulated in the tailpipe ignites and long flames are blown out of exhaust nozzle. Possibility of this hazard must be watched and all flammable materials kept in the clear.

(3) Toxicity. Tests have indicated that carbon monoxide content is low but other gases are present which have disagreeable odor and are irritating in effect. Exposure will usually cause watering or burning sensation of the eyes. Less noticeable but important is respiratory irritation which may be caused. For both these reasons exposure must be avoided, particularly in confined spaces or pockets where concentration may build up.

D. Engine Cool Down

(1) After engine operation no work or inspection shall be done on tailpipe for at least one-half hour, preferably longer. All other parts may usually be worked upon without danger.

E. Engine Noise

(1) Jet engines typically make noise that can cause temporary (as well as permanent) loss of hearing. When trim procedures are done on engines installed in aircraft, the result of loud noise can be damage to hearing, and all personnel must use some protective equipment. Noise can have an effect on the inner ear with the result that it can be difficult to walk or stand in a stable manner. Therefore, cup-type ear protection is recommended. If engines are to be serviced from aero-stands or platforms, these must have protective railings to prevent falls.

F. Engine Ignition

WARNING: THE JT8D ENGINE IGNITION SYSTEM IS CHARACTERISTICALLY HIGH IN ENERGY. THE NATURE OF THE SYSTEM IS SUCH AS TO RENDER IT A HAZARDOUS, POSSIBLY FATAL, SOURCE OF ELECTRICAL SHOCK UNLESS NECESSARY PRECAUTIONS ARE EXERCISED. DO NOT TOUCH

IGNITER PLUGS WHEN IGNITION IS ON. DO NOT TEST IGNITION SYSTEM WHEN PERSONNEL MAY BE IN CONTACT WITH IGNITER PLUGS OR WHEN FLAMMABLE MATERIALS ARE NEARBY.

G. Fuel and Lubricating Oils

(1) All fuels and lubricating oils tend to dry the skin. Precautions shall be taken to avoid contact as much as possible.

Task 72-00-00-760-002:

2. Testing Information

A. General

(1) Pratt & Whitney strongly recommends that the measurement and setting of engine thrust be accomplished by use of turbine discharge pressure and compressor inlet pressure as the primary parameters, while using engine speed, tailpipe temperature, and fuel flow as secondary parameters to monitor engine condition, and as limits. Engine speed (low and high compressor rpm) is not a sufficiently accurate indicator of thrust, to provide adequate control of engine thrust and internal conditions under normal service operation. Therefore, the engine fuel control is adjusted in order to obtain desired turbine discharge pressure (Pt7) shown on applicable engine trim curves. Turbine discharge pressure or pressure ratio overshoot, or higher than normal reading, may be noted when power lever is first advanced to PART THRUST stop on a cold engine. For accurate indication of engine thrust during engine test or trimming, engine must be allowed to stabilize.

NOTE: It is suggested that a remote fuel control trimmer such as is available from Lear Siegler Inc. be employed when trimming engine.

(2) Whenever trimming engines installed in aircraft, aircraft manufacturer's trim curves, corrected for specific inlet duct loss, must be used.

(3) Symbols have been designated for the various stations within the engine, and the external working pressures and temperatures. These variables are listed below:

Tamb -	Compressor Ambient Temperature
Pamb -	Compressor Inlet Ambient Pressure
N1 -	Low Pressure Compressor Rpm
N2 -	High Pressure Compressor Rpm
Ps3 -	Intercompressor Static Pressure
Ps4 -	Bleed Annulus
Pt2 -	Compressor Inlet Total Pressure
Tt7 -	Turbine Discharge Total Temperature
Pt7 -	Turbine Discharge Total Pressure
Pt7/Pamb -	Engine Pressure Ratio
T.B. -	True Barometric (Inches Hg Absolute)

(4) The extent of repair and replacement will vary with each engine; therefore, the degree of test necessary to demonstrate satisfactory repair will vary also. To minimize ground running and to conserve fuel, this section provides five ground test procedures which are related to the extent of repair or replacement. Before attempting to test an engine after repair, the applicable sections of the "Repair Reference Table" must be consulted to determine the test required for any given engine repair.

(5) The Engine Check Chart provides the general operating condition limits and references to the necessary test curves for testing an installed engine. The ratings listed in the Engine Check Chart are described as follows and are obtained by positioning the power lever to a predetermined turbine discharge pressure (Pt7):

(a) Takeoff - This is the maximum thrust certified for take-off. The rating is set by adjusting the throttle to obtain a predetermined engine pressure ratio. The rating is time-limited to five minutes.

(b) Maximum Continuous - The Maximum Continuous Rating is the maximum thrust certified for continuous use. For the purpose of P&W service policy coverage and prolonging engine life, this rating should be used, at the pilot's discretion, only when required to ensure safe flight. The rating is set by adjusting the throttle to obtain a predetermined engine pressure ratio.

(c) Maximum Climb - Maximum Climb thrust is the maximum thrust approved for normal climb. The rating is set by adjusting the throttle to obtain a predetermined engine pressure ratio.

(d) Maximum Cruise - This is the maximum thrust approved for cruising. Maximum Cruise is obtained in the same manner as Maximum Climb or Maximum Continuous thrust.

(e) Idle - This is not an engine rating but, rather, a power lever position suitable for minimum thrust operation on the ground or in flight. It is obtained by positioning the power lever in the IDLE detent or the IDLE stop position.

(f) Reverse - Reverse thrust will be obtained at power lever positions below IDLE.

B. Operating Limits and Performance Data.

(1) JT8D-1, -1A, -1B. See Table 501.

Oil: PWA 521 Fuel: See SB 2016

Operating Condition	Operating Limits (1)			
Thrust Setting	Time Limits (Minutes)	Max. Observed Exhaust Gas Temp. °F/(°C)	Oil Pressure (psig) (6)(7) Normal	Maximum Oil Temp. °F/(°C) (3)
Take-Off	5	JT8D-1 1058°F (570°C) JT8D-1A 1076°F (580°C) JT8D-1B 1094°F (590°C)	40 to 55	248°F (120°C)
Maximum Continuous (2) and Maximum Climb	Continuous	JT8D-1 995°F (535°C) JT8D-1A 1004°F (540°C) JT8D-1B 1013°F (545°C)	40 to 55	248°F (120°C)
Maximum Cruise	Continuous	950°F (510°C)	40 to 55	248°F (120°C)
Idle	Continuous	896°F (480°C)(4)	40 Min.	248°F (120°C)

Engine Check Chart
For JT8D-1,-1A,-1B
Table 501

Oil: PWA 521 Fuel: See SB 2016

Operating Condition	Operating Limits (1)			
Thrust Setting	Time Limits (Minutes)	Max. Observed Exhaust Gas Temp. °F/(°C)	Oil Pressure (psig) (6)(7) Normal	Maximum Oil Temp. °F/(°C) (3)
Starting		662°F (350°C) (5)	(8)	
		778°F (420°C) (5)		
Acceleration (3)		JT8D-1 1058°F (570°C) JT8D-1A 1076°F (580°C) JT8D-1B 1094°F (590°C)	40 to 55	248°F (120°C)

Engine Check Chart
For JT8D-1,-1A,-1B
Table 501 (Continued)

(a) JT8D-1,-1A,-1B Performance Notes for Table 501.

NOTE: (1) Whenever operating limits shown in ENGINE CHECK CHART and accompanying NOTES are exceeded, operating crew must take whatever action is necessary, flight conditions permitting, to return operation within limits. All such incidents should be recorded in the Aircraft Flight Log, stating the maximum values observed and the length of time above limits or (in the case of low oil pressure) below the limit. This information is essential for effective incident investigation by maintenance personnel. Refer to Task 72-00-00-810-005 Troubleshooting-03 for required maintenance actions.

NOTE: (2) Maximum Climb and Maximum Continuous thrust are the same.

NOTE: (3) Acceleration limit is intended only to allow for transitory EGT indications. Stabilized EGT must be at or below Operating Limit for applicable Operating Condition within two minutes of advancing throttle.

NOTE: (4) 896°F (480°C) applies when airbleed or power extraction is being used. When no airbleed or power extraction is used, 778°F (420°C) applies. This is a reference temperature which, if exceeded, would indicate an abnormal engine operating condition. Further operation of an engine exhibiting this condition should be at the discretion of the operator.

NOTE: (5) 662°F (350°C) applies at ambient temperatures of 59°F and below. 778°F (420°C) applies at ambient temperatures above 59°F. These temperatures are time limited to momentary for starting. If maximum allowable starting temperature is exceeded, engine should be shut down and inspected. The starting period ends when N2 rpm stabilizes with aircraft throttle in Idle detent.

NOTE: (6) Oil pressure is difference between main oil pump output and oil scavenge compartment pressure. Oil pressure can be read directly from cockpit gage if oil pressure transmitter is vented to scavenge compartment of engine; if transmitter is not vented to scavenge compartment, oil pressure may be calculated as follows:

(a) Determine scavenge compartment breather

(b) Subtract scavenge compartment breather pressure from aircraft oil pressure gag reading to determine main oil pressure.

NOTE: (7) Normal oil pressure range is 40 - 55 psi. When oil pressure above normal is encountered, other engine instruments should be monitored closely for remainder of flight, since high oil pressure may indicate a developing internal malfunction.

At Idle and above, oil pressure between 35 and 40 psi is undesirable, and should be tolerated only for completion of flight, preferably at reduced throttle setting. Minimum oil pressure is 35 psi. Oil pressure below 35 psi may result in engine damage and should be avoided whenever possible. If continued operation of an affected engine is considered necessary, its thrust should be reduced to as low a level as flight conditions permit, until a landing is accomplished. Oil pressure above and below normal range should be reported as an engine discrepancy, and should be corrected before the next take-off.

NOTE: (8) During cold weather starting, oil pressure in excess of 55 psig may be evidenced until oil viscosities are reduced by increasing oil temperature. Engine operation is limited to idle power when oil pressure is in excess of 55 psig during cold weather starts.

NOTE: (9) See "Oil Inlet Overtemperature Limits and Procedures", for procedures related to oil temperature.

(2) JT8D-7, -7A, -7B. See Table 502.

Oil: PWA-521 Fuel: See SB 2016

Operating Condition	Operating Limits (1)			
Thrust Setting	Time Limits (Minutes)	Max. Observed Exhaust Gas Temp. °F/(°C)	Oil Pres. (psig) (6)(7) Normal	Maximum Oil Temp. °F/(°C) (9)
Take Off	5	JT8D-7 1058°F (570°C) JT8D-7A 1076°F (580°C) JT8D-7B 1094°F (590°C)	40 - 55	248°F (120°C)

Engine Check Chart
For JT8D-7,-7A,-7B
Table 502

Oil: PWA-521 Fuel: See SB 2016

Operating Condition	Time Limits (Minutes)	Operating Limits (1) Max. Observed Exhaust Gas Temp. °F/(°C)	Oil Pres. (psig) (6)(7) Normal	Maximum Oil Temp. °F/(°C) (9)
Thrust Setting Max. Climb and Max. Continuous (2)	Continuous	JT8D-7 995°F (535°C) JT8D-7A 1004°F (540°C) JT8D-7B 1013°F (545°C)	40 - 55	248°F (120°C)
Maximum Cruise	Continuous	950°F (510°C)	40 - 55	248°F (120°C)
Idle	Continuous	896°F (480°C)(4) 788°F (420°C)(4)	40 Min.	248°F (120°C)
Starting		662°F (350°C) (5)	(8)	
		788°F (420°C) (5)		
Acceleration (3)		JT8D-7 1058°F (570°C) JT8D-7A 1076°F (580°C) JT8D-7B 1094°F (590°C)	40 - 55	248°F (120°C)

Engine Check Chart
For JT8D-7,-7A,-7B
Table 502 (Continued)

(a) JT8D-7,-7A,-7B Performance Notes for Table 502.

NOTE: (1) Whenever operating limits shown in Engine Check Chart and accompanying Notes are exceeded, operating crew must take whatever action is necessary, flight conditions permitting, to return operation

within limits. All such incidents should be recorded in Aircraft Flight Log, stating the maximum values observed and length of time above limits or (in the case of low oil pressure) below limit. This information is essential for effective incident investigation by maintenance personnel. Refer to Task 72-00-00-810-005 Troubleshooting-03 for required maintenance actions.

NOTE: (2) Maximum Climb and Maximum Continuous thrust are the same below 1,500 feet and above 20,000 feet.

NOTE: (3) Acceleration limit is intended only to allow for transitory EGT indications. Stabilized EGT must be at or below Operating Limit for applicable Operating Condition within two minutes of advancing throttle.

NOTE: (4) 896°F (480°C) applies when airbleed or power extraction is being used. When no airbleed or power extraction is used, 778°F (420°C) applies. This is a reference temperature which, if exceeded, would indicate an abnormal engine operating condition. Further operation of an engine exhibiting this condition should be at the discretion of the operator.

NOTE: (5) 662°F (350°C) applies at ambient temperatures of 59°F and below. 778°F (420°C) applies at ambient temperatures above 59°F. These temperatures are time limited to momentary for starting. If maximum allowable starting temperature is exceeded, engine should be shut down and inspected. The starting period ends when N2 rpm stabilizes with aircraft throttle in Idle detent.

NOTE: (6) Oil pressure is difference between main oil pump output and oil scavenge compartment pressure. Oil pressure can be read directly from cockpit gage if oil pressure transmitter is vented to scavenge compartment of engine; if transmitter is

not vented to scavenge compartment, oil pressure may be calculated as follows:

(a) Determine scavenge compartment breather pressure.

(b) Subtract scavenge compartment breather pressure from aircraft oil pressure gage reading to determine main oil pressure.

NOTE: (7) Normal oil pressure range is 40 - 55 psi. When oil pressure above normal is encountered, other engine instruments should be monitored closely for the remainder of the flight, since high oil pressure may indicate a developing internal malfunction. At Idle and above, oil pressure between 35 and 40 psi is undesirable, and should be tolerated only for completion of flight, preferably at a reduced throttle setting. Minimum oil pressure is 35 psi. Oil pressure below 35 psi may result in engine damage and should be avoided whenever possible. If continued operation of an affected engine is considered necessary, its thrust should be reduced to as low a level as flight conditions permit, until a landing is accomplished. Oil pressures above and below normal range should be reported as an engine discrepancy, and should be corrected before the next take-off.

NOTE: (8) During cold weather starting, oil pressure in excess of 55 psig may be evidenced until oil viscosities are reduced by increasing oil temperature. Engine operation is limited to idle power when oil pressure is in excess of 55 psig during cold weather starts.

NOTE: (9) See "Oil Inlet Overtemperature Limits and Procedures", for procedures related to oil temperature.

(3) JT8D-9,-9A. See Table 503.

Oil: PWA 521 Fuel: See SB 2016

Operating Condition	Operating Limits (1)			
Thrust Setting	Time Limits (Minutes)	Max. Observed Exhaust Gas Temp. °F/(°C)	Oil Pressure (psig) (6)(7) Normal	Maximum Oil Temp. °F/(°C) (9)
Take Off	5	JT8D-9 1076°F (580°C) JT8D-9A 1094°F (590°C)	40 - 55	248°F (120°C)
Max. Climb and Max. Continuous (2)	Continuous	JT8D-9 1004°F (540°C) JT8D-9A 1013°F (545°C)	40 - 55	248°F (120°C)
Maximum Cruise	Continuous	JT8D-9 968°F (520°C) JT8D-9A 977°F (525°C)	40 - 55	248°F (120°C)
Idle (3)	Continuous	896°F (480°C) 788°F (420°C)	40 Min.	248°F (120°C)
Starting (4)		662°F (350°C) 788°F (420°C)	(8)	
Acceleration (5)		JT8D-9 1076°F (580°C) JT8D-9A 1094°F (590°C)	40 - 55	248°F (120°C)

Engine Check Chart for JT8D-9,-9A
Table 503

(a) JT8D-9,-9A Performance Notes for Table 503.

NOTE: (1) Whenever the operating limits shown in the ENGINE Operating Limits Chart and in the accompanying NOTES are exceeded, the operating crew must take whatever action is necessary, flight conditions permitting, to return operation within

limits. All such incidents should be recorded in the Aircraft Flight Log, stating the maximum values observed and length of time above limits, or (in the case of low oil pressure) below the limit. This information is essential for effective incident investigation by maintenance personnel. Refer to Task 72-00-00-810-005 Troubleshooting-03, for required maintenance actions.

NOTE: (2) Maximum Climb and Maximum Continuous thrust are the same below 1500 feet and above 20,000 feet.

NOTE: (3) 480°C applies when airbleed or power extraction is being used. When no airbleed or power extraction is used, 778°F (420°C) applies. This is a reference temperature which, if exceeded, would indicate an abnormal engine operating condition. Further operation of an engine exhibiting this condition should be at the discretion of the operator.

NOTE: (4) 350°C applies to ambient temperatures of 59°F and below. 420°C applies to ambient temperatures above 59°F. These temperatures are time limited to momentary for starting. If the maximum allowable starting temperature is exceeded, the engine should be shut down and inspected. The starting period ends when N2 rpm stabilizes with the aircraft throttle in the Idle detent.

NOTE: (5) Acceleration limit is intended only to allow for transitory EGT indications. Stabilized EGT must be at or below Operating Limit for applicable Operation Condition within two minutes of advancing throttle.

NOTE: (6) Oil pressure is difference between main oil pump output and oil scavenge compartment pressure. Oil pressure can be read directly from cockpit gage if oil pressure transmitter is vented to scavenge compartment of engine; if transmitter is

not vented to scavenge compartment, oil pressure may be calculated as follows:

(a) Determine scavenge compartment breather pressure.

(b) Subtract scavenge compartment breather pressure from aircraft oil pressure gage reading to determine main oil pressure.

NOTE: (7) Normal oil pressure range is 40 - 55 psi. When oil pressure above normal is encountered, other engine instruments should be monitored closely for the remainder of the flight, since high oil pressure may indicate a developing internal malfunction. At Idle and above, oil pressure between 35 and 40 psi is undesirable, and should be tolerated only for the completion of the flight, preferable at a reduced throttle setting. Minimum oil pressure is 35 psi. Oil pressure below 35 psi may result in engine damage and should be avoided whenever possible. If continued operation of an affected engine is considered necessary, its thrust should be reduced to as low a level as flight conditions permit, until a landing is accomplished. Oil pressures above and below the normal range should be reported as an engine discrepancy, and should be corrected before the next takeoff.

NOTE: (8) During cold weather starting, oil pressure in excess of 55 psig may be evidenced until oil viscosities are reduced by increasing oil temperature. Engine operation is limited to idle power when oil pressure is in excess of 55 psig during cold weather starts.

NOTE: (9) See "Oil Inlet Overtemperature Limits and Procedures", for procedures related to oil temperature.

(4) JT8D-11. See Table 504.

OIL: PWA 521 Operating Condition			FUEL: SEE SB 2016 Operating Limits (1)	
Thrust Setting	Time Limits (Minutes)	Maximum Observed Exh. Gas Temp. °F(°C)	Oil Pressure (Psig) (5)(6) Normal	Maximum Oil Temp. °F/(°C) (8)
Take-Off	5	1103°F (595°C)	40 - 55	266°F (130°C)
Max. Climb and Max. Continuous (8)	Continuous	1022°F (550°C)	40 - 55	266°F (130°C)
Max. Cruise	Continuous	968°F (520°C)	40 - 55	266°F (130°C)
Idle	Continuous	1038°F (559°C) (2) 930°F (499°C) (7)	40 Min.	266°F (130°C)
Ground Starting				
JT8D-11 (Pre-SB 5455)		950°F (510°C) (3)		
JT8D-11 (Post-SB 5455)		986°F (530°C) (3)		
Flight		1022°F (550°C) (3)		
Acceleration		1103°F (595°C) (4)	40 - 55	266°F (130°C)

Engine Check Chart for JT8D-11
Table 504

(a) JT8D-11 Performance Notes for Table 504

NOTE: (1) Whenever the operating limits shown in the ENGINE CHECK CHART and accompanying NOTES are exceeded, the operating crew must take whatever action is necessary, flight conditions permitting, to return operation within limits. All such incidents should be recorded in the Aircraft Flight Log, stating the maximum values observed and

the length of time above limits, or (in the case of low oil pressure) below the limit. This information is essential for effective incident investigation by maintenance personnel. Refer to Task 72-00-00-810-005 Troubleshooting-03, for required maintenance actions.

NOTE: (2) 559°C applies when airbleed or power extraction is being used. When no airbleed or power extraction is used, 930°F (499°C) applies. This is a reference temperature which, if exceeded, would indicate an abnormal engine operating condition. Further operation of an engine exhibiting this condition should be at the discretion of the operator.

NOTE: (3) The use of fast-response EGT probes on this engine eliminates the need for two ground starting temperature limits. The higher in-flight starting temperature limit is required since consistent airstarts are not obtainable at or below the lower ground start temperature limit.

NOTE: (4) Acceleration limit is intended only to allow for transitory EGT indications. Stabilized EGT must be at or below Operating Limit for applicable Operation Condition within two minutes of advancing throttle.

NOTE: (5) Oil pressure is difference between main oil pump output and oil scavenge compartment pressure. Oil pressure can be read directly from cockpit gage if oil pressure transmitter is vented to scavenge compartment of engine; if transmitter is not vented to scavenge compartment, oil pressure may be calculated as follows:

(a) Determine scavenge compartment breather pressure.

(b) Subtract scavenge compartment breather pressure from aircraft oil pressure gage reading to determine main oil pressure.

NOTE: (6) Normal oil pressure range is 40 - 55 psi. When oil pressure above normal is encountered, other engine instruments should be monitored closely for the remainder of the flight, since high oil pressure may indicate a developing internal malfunction. At Idle and above, oil pressure between 35 and 40 psi is undesirable, and should be tolerated only for the completion of the flight, preferably at a reduced throttle setting. Minimum oil pressure is 35 psi. Oil pressure below 35 psi may result in engine damage and should be avoided whenever possible. If continued operation of an affected engine is considered necessary, its thrust should be reduced to as low a level as flight conditions permit, until a landing is accomplished. Oil pressures above and below the normal range should be reported as an engine discrepancy, and should be corrected before the next takeoff.

NOTE: (7) During cold weather starting, oil pressure in excess of 55 psig may be evidenced until oil viscosities are reduced by increasing oil temperature. Engine operation is limited to idle power when oil pressure is in excess of 55 psig during cold weather starts.

NOTE: (8) See "Oil Inlet Overtemperature Limits and Procedures", for procedures related to oil temperature.

NOTE: (9) Maximum Continuous and Maximum Climb thrust are same below 1,500 feet and compressor inlet temperatures (Tt2) of less than 63°F (17.3°C).

(5) JT8D-15 and -15A. See Table 505.

OIL: PWA-521 FUEL: See SB 2016

Operating Conditions			Operating Limits (1)	
Thrust Setting	Time Limit (Minutes)	Max. Observed Exhaust Gas Temp. °F/(°C)	Oil Pressure (PSIG) Normal (6)(7)	Maximum Oil Temp. °F/(°C) (9)
Takeoff	5	1148°F (620°C)	40-55	266 (130)
Maximum Climb and (2)	Continuous	1076°F (580°C)	40-55	266 (130)
Maximum Continuous (2)	Continuous	1076°F (580°C)	40-55	266 (130)
Maximum Cruise	Continuous	1022°F (550°C)	40-55	266 (130)
Idle	Continuous	JT8D-15: 995°F (535°C) (4) JT8D-15A: 1038°F (559°C) (4)	40 Min.	266 (130)
Ground (JT8D-15)		1022°F (550°C (5)	(8)	
Starting Ground (JT8D-15A)		1067°F (575°C)		
Flight		1148°F (620°C)(5)		
Acceleration (3)		1166°F (630°C)	40-55	266 (130)

Engine Check Chart
For JT8D-15,-15A
Table 505

(a) JT8D-15,-15A Performance Notes for Table 505.

NOTE: (1) Whenever any of the operating limits shown in the ENGINE CHECK CHART and accompanying NOTES are exceeded, the operating crew must take whatever action is

necessary, flight condition permitting, to return operation within limits. All such incidents should be recorded in the Aircraft Flight Log, stating the maximum values observed and the length of time above limits or (in the case of low oil pressure) below the limit. This information is essential for effective incident investigation by maintenance personnel. Refer to Task 72-00-00-810-005 Troubleshooting-03, for required maintenance actions.

NOTE: (2) Maximum Climb and Maximum Continuous thrust are the same below 1500 feet and compressor inlet temperatures (Tt2) of less than 78°F (25.5°C). (Refer to Engine Ratings and Throttle Settings.)

NOTE: (3) Acceleration limit is intended only to allow for transitory EGT indications. Stabilized EGT must be at or below Operating Limit for applicable Operation Condition within two minutes of advancing throttle.

NOTE: (4) 535°C (JT8D-15) or 559°C (JT8D-15A) applies when airbleed or power extraction is being used. When no airbleed or power extraction is used, 475°C (JT8D-15) or 499°C (JT8D-15A) applies. This is a reference temperature which, if exceeded, would indicate an abnormal engine operating condition. Further operation of an engine exhibiting this condition should be at the discretion of the operator.

NOTE: (5) These temperatures are time-limited to momentary for starting. If the maximum allowable starting temperature is exceeded, the engine should be shut down and inspected in accordance with the instructions in this section. The starting period ends when N2 rpm essentially stabilizes with the aircraft throttle in the Idle detent. The use of the new fast-response EGT probes on this engine eliminates the need for two ground starting temperature limits. The higher

in-flight starting temperature limit is required since consistent airstarts are not obtainable at or below the lower ground-start temperature limit.

NOTE: (6) Oil pressure is difference between main oil pump output and oil scavenge compartment pressure. Oil pressure can be read directly from cockpit gage if oil pressure transmitter is vented to scavenge compartment of engine; if transmitter is not vented to scavenge compartment, oil pressure may be calculated as follows:

(a) Determine scavenge compartment breather pressure.

(b) Subtract scavenge compartment breather pressure from aircraft oil pressure gage reading to determine main oil pressure.

NOTE: (7) Normal oil pressure range is 40 - 55 psi. When oil pressure above normal is encountered, other engine instruments should be monitored closely for the remainder of the flight since high oil pressure may indicate a developing internal malfunction. At Idle and above, oil pressure between 35 and 40 psi is undesirable and should be tolerated only for the completion of the flight, preferably at reduced throttle setting. Minimum oil pressure is 35 psi. Oil pressure below 35 psi may result in engine damage and should be avoided whenever possible. If continued operation of an affected engine is considered necessary, its thrust should be reduced to as flight conditions permit, until a landing is accomplished. Oil pressures above and below normal should be reported as an engine discrepancy and should be corrected for the next takeoff.

NOTE: (8) During cold weather starting, oil pressure in excess of 55 psig may be evidenced until oil viscosities are reduced by increasing oil temperature. Engine operation is limited to idle power when oil pressure is in excess of 55 psig during cold weather starts.

NOTE: (9) See "Oil Inlet Overtemperature Limits and Procedures," for procedures related to oil temperature.

(6) JT8D-17,-17A,-17R and -17AR. See Table 506.

OIL: PWA 521 FUEL: See SB 2016

Operation Conditions			Operating Limits	
Thrust Setting	Time Limit (Minutes)	Max. Observed Exhaust Gas Temp. °F/(°C)	Oil Pressure (PSIG) Normal (7) (8)	Maximum Oil Temp. °F/(°C) (10)
Maximum Takeoff (JT8D-17R,-17AR)	5 (3)	1274°F (690°C)	40-55	266 (130)
Normal Takeoff (JT8D-17R,-17AR)	5	1202°F (650°C)	40-55	266 (130)
Takeoff (JT8D-17,-17A)	5	1202°F (650°C)	40-55	266 (130)
Maximum Climb and (2)	Continuous	1130°F (610°C)	40-55	266 (130)
Maximum Continuous (2)	Continuous	1130°F (610°C)	40-55	266 (130)
Maximum Cruise	Continuous	1076°F (580°C)	40-55	266 (130)
Idle	Continuous	JT8D-17,-17R: 995°F (535°C) (5) JT8D-17A,-17AR: 1038°F (559°C) (5)	40 Min.	266 (130)

Engine Check Chart For
JT8D-17,-17A,-17R,-17AR
Table 506

OIL: PWA 521 FUEL: See SB 2016

Operation Conditions			Operating Limits	
Thrust Setting	Time Limit (Minutes)	Max. Observed Exhaust Gas Temp. °F/(°C)	Oil Pressure (PSIG) Normal (7) (8)	Maximum Oil Temp. °F/(°C) (10)
Ground (JT8D-17,-17R)		1022°F (550°C) (9)		
Starting Ground (JT8D-17A,-17AR)		1067°F (575°C)		
Flight		1202°F (650°C) (6)		
Acceleration (4)		1220°F (660°C)	40-55	266 (130)

Engine Check Chart For
JT8D-17,-17A,-17R,-17AR
Table 506 (Continued)

(a) JT8D-17,-17A,-17R,-17AR Performance Notes for Table 506.

NOTE: (1) Whenever any of the operating limits shown in the ENGINE CHECK CHART and accompanying NOTES are exceeded, the operating crew must take whatever action is necessary, flight condition permitting, to return operation within limits. All such incidents should be recorded in the Aircraft Flight Log, stating the maximum values observed and the length of time above limits or (in the case of low oil pressure) below the limit. This information is essential for effective incident investigation by maintenance personnel. Refer to Task 72-00-00-810-005 Troubleshooting-03, for required maintenance actions.

NOTE: (2) Maximum Climb, Maximum Continuous and Maximum Cruise thrust varies with altitude and with ambient temperature relative to standard and standard ± 10°C (± 18°F). (Refer to Engine Ratings and Throttle Settings.)

NOTE: (3) Maximum Takeoff thrust (in Reserve Takeoff Thrust Mode) is time-limited to total of five minutes including operating time at both Normal Takeoff and Maximum Take-off Thrust Levels.

NOTE: (4) Acceleration limit is intended only to allow for transitory EGT indications. Stabilized EGT must be at or below Operating Limit for applicable Operation Condition within two minutes of advancing throttle.

NOTE: (5) 535°C (JT8D-17,-17R) or 559°C (JT8D-17A,-17AR) applies when airbleed or power extraction is being used. When no airbleed or power extraction is used, 475°C (JT8D-17, -17R) or 499°C (JT8D-17A,-17AR) applies. This is a reference temperature which, if exceeded, would indicate an abnormal engine operating condition. Further operation of an engine exhibiting this condition should be at the discretion of the operator.

NOTE: (6) These temperatures are time-limited to momentary for starting. If the maximum allowable starting temperature is exceeded, the engine should be shut down and inspected per the instructions in this section. The starting period ends when N2 rpm essentially stabilizes with the aircraft throttle in the Idle detent. The use of the new fast-response EGT probes on this engine eliminates the need for two ground starting temperature limits. The higher in-flight starting temperature limit is required since consistent airstarts are not obtainable at or below the lower ground-start temperature limit.

NOTE: (7) Oil pressure is difference between main oil pump output and oil scavenge pump compartment pressure. Oil pressure can be read directly from cockpit gage if oil pressure transmitter is vented to scavenge compartment of engine; if transmitter is not vented to scavenge compartment, oil pressure may be calculated as follows:

(a) Determine scavenge compartment breather pressure.

(b) Subtract scavenge compartment breather pressure from aircraft oil pressure gage reading to determine main oil pressure.

NOTE: (8) Normal oil pressure range is 40 - 55 psi. When oil pressure above normal is encountered, other engine instruments should be monitored closely for the remainder of the flight, since high oil pressure may indicate a developing internal malfunction. At Idle and above, oil pressure between 35 and 40 psi is undesirable and should be tolerated only for the completion of the flight, preferably at a reduced throttle setting. Minimum oil pressure is 35 psi. Oil pressure below 35 psi may result in engine damage and should be avoided whenever possible. If continued operation of an affected engine is considered necessary, its thrust should be reduced to as low a level as flight conditions permit, until a landing is accomplished. Oil pressures above and below normal should be reported as an engine discrepancy and should be corrected for the next take-off.

NOTE: (9) During cold weather starting, oil pressure in excess of 55 psig may be evidenced until oil viscosities are reduced by increasing oil temperature. Engine operation is limited to idle power when oil pressure is in excess of 55 psig during cold weather starts.

NOTE: (10) See "Oil Inlet Overtemperature Limits and Procedures", for procedures related to oil temperature.

C. Engine Overspeed (Other than JT8D-17R,-17AR)

(1) Maximum overspeed limits are 8980 rpm (104.5 percent) for N1 and 12,550 rpm (102.4 percent) for N2.

(a) The maximum permissible engine operating speeds are 12,250 rpm (100.04 percent) for N2 and 8600 rpm (100.1 percent) for N1 (8800 rpm (102.4 percent) N1 for JT8D-15,-15A,-17 and -17A).

(b) For all engine models, 100 percent N1 and N2 speeds are 8589 rpm and 12,245 rpm, respectively.

(c) It is necessary to record all excursions that are more than the above limits as engine discrepancies. The discrepancy report must include the highest speed of the rotor and the elapsed time the rotor was at that speed.

(2) Engines run at speeds between 8600 - 8980 rpm (N1) (8800 - 8980 rpm (N1) for JT8D-15,-15A,-17, and -17A) or 12250 - 12550 rpm (N2) must get a visual inspection of the inlet and exhaust for foreign particles, evidence of rotor rub, or blade or vane damage. Make sure that the rotors turn freely and find the cause of overspeed before the engine is continued in service.

(3) If visual inspection reveals physical damage, or if N1 speed exceeds 8980 rpm (104.5 percent) or if N2 speed exceeds 12,550 rpm (102.4 percent) proceed as follows:

(a) Remove the compressor and turbine of the rotor or rotors that had the overspeed condition and do a full detail-part inspection of the rotating parts (refer to the applicable inspection sections for inspection requirements) (this must include all applicable visual and non-destructive inspections).

(b) Do growth and hardness inspections on the turbine disks of the rotor or rotors which had the overspeed condition.

(c) If the N2 rotor had the overspeed, do a stretch inspection of all 1st stage turbine blades.

D. Engine Overspeed (JT8D-17R,-17AR)

NOTE: 100 percent N1 and N2 speeds are 8589 rpm and 12,245 rpm, respectively.

(1) Normal takeoff power level engine speed limits.

(a) Maximum permissible operating speeds are 8900 rpm (103.6 percent) for N1 and 12,280 rpm (100.3 percent) for N2.

(b) Maximum overspeed limits are 9250 rpm (107.7 percent) for N1 and 12,600 rpm (102.9 percent) for N2.

(c) Engines run at speeds between 8900 - 9250 rpm N1 or 12,280 - 12,600 rpm N2 at Normal Takeoff power must get a visual inspection of the inlet and exhaust for foreign particles, evidence of rotor rub, or blade or vane damage. Make sure that the rotors turn freely and find the cause of overspeed before the engine is continued-in-service.

(2) Maximum Takeoff power level engine speed limits.

(a) Maximum permissible operating speeds are 9250 rpm (107.7 percent) for N1 and 12,600 rpm (102.9 percent) for N2.

(b) No overspeed is permitted beyond limits given in (2)(a) at Maximum Takeoff power.

(3) All excursions beyond allowable limits in (1) or (2) must be reported as engine discrepancies. Discrepancy report shall include maximum rotor speed attained and exposure time of rotor to speed above limits.

(4) If visual inspection reveals physical damage, or if N1 speed exceeds 9250 rpm (107.7 percent), or if N2 speed exceeds 12,600 rpm (102.9 percent), proceed as follows:

(a) Remove the compressor and turbine of the rotor or rotors that had the overspeed condition and do a full detail-part inspection of the rotating parts (refer to the applicable inspection sections for inspection requirements) (this must include all applicable visual and non-destructive inspections).

(b) Do growth and hardness inspections on the turbine disks of the rotor or rotors which had the overspeed condition.

(c) If the N2 rotor had the overspeed, do a stretch inspection of all 1st stage turbine blades.

E. Overtemperature

(1) Conditions of overtemperature may be incurred either in the aircraft or on the test stand. Such conditions may be anticipated by excessively rapid increase in fuel flow, high pressure compressor rpm and/or temperature. When an overtemperature condition is anticipated or has occurred on the test stand, perform a normal engine shutdown. Avoid an emergency shutdown unless it is obvious that continued engine operation would result in more than overtemperature damage. The engine should not be restarted until the cause of the overtemperature is corrected and inspection shows that both compressors will rotate normally.

(2) Several momentarily high overtemperatures have as profound an effect on the expected service life of an engine as a single prolonged overtemperature of lesser degree. The higher the overtemperature, the less the time interval before serious engine damage occurs and, therefore, the more extensive the inspection required. Conversely, the lower the overtemperature the more time before serious damage occurs and the less stringent the inspection required.

(3) The overtemperature limits (Figures 502 and 503) present the inspection procedures to be followed after an engine has been subject to an overtemperature condition. Whenever inspection procedures require a Hot Section inspection, refer to Chapter/Section 72-40-00, Inspection/Check-01. Whenever inspection procedures require optical metallographic inspection, refer to the JT8D ENGINE MANUAL, Chapter/Sections 72-52-01 and 72-53-11, -12, and -13, Inspection.

F. Guideline Oil Consumption Values

(1) To monitor the rate of oil consumption, it is necessary to keep accurate records of engine hours and quantities of oil added. The quantities of oil added are an important value and make it necessary for the mechanic to:

(a) Do a check of the correct oil quantity with the instructions in Task 72-00-00-210-015, Inspection/Check-01, Oil Level Check, Change, And Strainers.

(b) Record accurately the quantity of oil (how many units) that were necessary to bring the oil to its correct level.

NOTE: It is important to use the same units at each servicing of the oil system when the quantities are recorded.

(c) Calculate and record the rate of oil consumption at each oil level check (it is important to do this whether or not oil was added after the check). The most accurate method is to fill the oil to the correct level at each oil level check. This one calculation during engine servicing will give the fastest warning of a problem.

(2) With usual engine operation, oil consumption for JT8D engines is as follows:

(a) Engines with a carbon-type No. 4 bearing seal: 0.10 - 1.00 quart/hour.

(b) Engines with a labyrinth-type No. 4 bearing seal: 0.20 - 2.00 quarts/hour.

(3) If one or more of these conditions occur in an engine, it will be necessary to do an engine inspection immediately and do all corrective actions:

(a) The oil consumption rate increases suddenly.

(b) The oil consumption rate continuously increases.

(c) The oil consumption rate is near or more than the maximum values specified above.

(d) More than half the maximum consumption specified above is internal oil leakage (refer to the subsequent procedure for more information about this).

CAUTION: TO PREVENT A POSSIBLE MAJOR ENGINE EVENT IN-SERVICE, ENGINE INSPECTIONS AND CORRECTIVE ACTIONS ARE NECESSARY. SUDDENLY INCREASED OIL CONSUMPTION OR CONTINOUSLY INCREASED OIL CONSUMPTION (THIS INCLUDES CONSUMPTION THAT IS LESS THAN THE MAXIMUM VALUE) CAN IDENTIFY A PROBLEM WITH THE ENGINE. THESE CONDITIONS SHOW THAT THERE CAN BE IMPORTANT PROBLEMS IN THE ENGINE'S BEARING COMPARTMENTS. IF THESE PROBLEMS ARE FOUND IN A SHORT TIME, THE RESULT CAN BE PLANNED MAINTENANCE AND NOT A MAJOR ENGINE EVENT. REFER TO Task 72-00-00-810-004, TROUBLESHOOTING-02, EXCESSIVE OIL LEAKAGE, FOR PROCEDURES TO HELP FIND AND CORRECT THESE PROBLEMS. REFER ALSO TO MAINTENANCE ADVISORY NOTICE MAN-JT8D-1-03 FOR MORE INFORMATION ABOUT MAJOR ENGINE EVENTS AND HOW TO MONITOR ENGINE OIL CONSUMPTION.

(4) Engine oil consumption values include external and internal oil leakage. It is usually possible to correct external oil leaks without engine disassembly and with the engine installed in the aircraft. To correct engine internal bearing compartment oil leaks, it is usually necessary to remove the engine.

(5) If an engine is at more than half of the specified oil consumption maximum rate, it cannot seal its internal compartments as usual, and it will be necessary to correct external leaks to find the internal oil consumption rate. If the internal leakage rate is more than half of the maximum values specified in this section, or If the total (internal and external) leakage rate is more than half of the maximum values specified (with external leaks not corrected), then more action will be necessary. Look at the engine's maintenance records and use engine experience to see if it will be necessary to monitor the engine carefully to prevent problems (see the procedures that follow).

NOTE: For engines that are post-ASB 5944 or post-SB 6101, a temperature indicator check is optional to the breather pressure check that follows.

(a) Do a breather pressure check. Refer to Task 72-00-00-760-004, Adjustment/Test-01, Test G. The limits that follow are applicable (corrective action will be necessary).

1 JT8D-1 thru -9A:

a Carbon-type No. 4 bearing seal: 1.75 psid

b Labyrinth-type No. 4 bearing seal: 2.00 psid

2 JT8D-11 thru -17AR:

a Carbon-type No. 4 bearing seal: 1.75 psid

b Labyrinth-type No. 4 bearing seal: 2.10 psid

(b) Continue to record the oil consumption rate.

(c) If necessary install oil temperature indicators (refer to ASB 5944 or SB 6101) and monitor them. Monitor the indicators each day but at intervals not more than 25 hours of engine operation.

G. Oil Inlet Overtemperature Limits and Procedures (JT8D-1,-1A, -1B,-7,-7A,-7B,-9,-9A)

(1) If, during operation, engine oil temperature exceeds maximum steady state temperature limit of 248°F (120°C) for not more than 15 minutes, the engine may be continued in service only after cause of temperature has been determined and corrected. If oil-in temperature exceeds maximum steady state temperature limit of 248°F (120°C) for more than 15 minutes but does not exceed 315°F (157°C), engine oil shall be drained, all external oil screen elements shall be inspected for foreign matter and corrective action taken for cause of overtemperature.

NOTE: After throttle reduction at end of Cruise and start of Descent, it is permissible for oil temperature to exceed 248°F (120°C) for not more than 15 minutes, provided it does not exceed 315°F (157°C), with no determination of cause or maintenance action.

(2) After complying with the above and providing no engine damage is indicated, engine may be continued in service.

(3) If oil-in temperature exceeds 315°F (157°C) for any interval, remove engine to overhaul and inspect all main and accessory drive bearings for hardness and condition. All main shaft seals shall be inspected for condition.

H. Oil Inlet Overtemperature Limits and Procedures (JT8D-11,-15,-15A,-17,-17A,-17R,-17AR)

(1) If, during operation, engine oil temperature exceeds steady state temperature limit of 266°F (130°C) for not more than 15 minutes, the engine may be continued in service only after cause of overtemperature has been determined and corrected. If oil-in temperature exceeds maximum steady state temperature of 266°F (130°C) for more than 15 minutes but does not exceed 329°F (165°C), engine oil shall be drained, all external oil screen elements shall be inspected for foreign matter, and corrective action taken for cause of overtemperature.

NOTE: After throttle reduction at end of Cruise and start of Descent, it is permissible for oil temperature to exceed 266°F (130°C) for not more than 15 minutes, provided it does not exceed 329°F (165°C), with no determination of cause or maintenance action.

(2) After complying with the above, and providing no engine damage is indicated, engine may be continued in service.

(3) If oil-in temperature exceeds 329°F (165°C) for any interval, remove engine to overhaul and inspect all main and accessory drive bearings for hardness and condition. All main shaft seals shall be inspected for condition.

I. Engine Windmilling or Oil Pressure Interruption/Low Oil Pressure

NOTE: 1. You must record operating conditions before and after any oil pressure interruption, low oil pressure indication, engine shutdown and windmilling to find the classification of windmilling.

NOTE: 2. The classification of windmilling is based on time and oil pressure. Although the engine must show continuous oil pressure after shutdown, the oil pressure after in-flight shutdown (IFSD) (after the engine becomes stable) is what is used for the classification of the windmilling. Because oil pressure is a function of ram air, this pressure will usually decrease to less than 10 psi (68.9 kPa) during flight phases where the ram air speed is not sufficient to get the pressure to this level. Also the oil pressure can show zero when the ram air can no longer cause sufficient oil pump rotation (during landing, roll-out, and taxi). These conditions are acceptable and do not change the classification of windmilling.

NOTE: 3. Engine windmilling inspections are intended to examine the engine after a windmilling event. The inspections are based on main oil pressure and time of windmilling. These inspections are necessary only if there is a problem with the oil delivery system (oil pressure) and are not required if this oil delivery system is serviceable. An engine check run is necessary to verify this.

(1) Engine Windmilling

(a) Examine all engines that have windmilled as a result of shutdown in flight.

NOTE: The operator must also do all corrective actions necessary to find the cause of the shutdown in flight.

NOTE: Chip detectors are optional equipment. If they are installed on the engine, inspection of them is part of the windmilling check procedure.

(b) If an engine windmilled for 30 minutes or less, with more than 10 psi of continuous oil pressure after shutdown, it can continue in service after satisfactory inspection of the main oil strainer and chip detectors (if installed), servicing of the engine and ground run-up.

NOTE: Ground run-up is a normal start, followed by five minutes at Idle then a normal shutdown.

NOTE: Chip detectors are optional equipment. If installed, they are part of the windmilling inspection procedure.

(c) If an engine windmills for more than 30 minutes, but less than 60 minutes, with more than 10 psi of continuous oil pressure after shutdown, can be continued in service after satisfactory examination of the main oil filter or strainer and chip detectors (if installed), servicing of the engine and ground run-up. In addition, use a Spectrometric Oil Analysis Program (SOAP) requesting concentrations of Iron (Fe), Vanadium (V) and Molybdenum (Mo) as indicators of main shaft bearing distress. Refer to the JT8D Oil Monitoring Guide (Part Number 821432), Section "G" for more information on SOAP. Do the main oil filter/strainer and chip detector (if installed) inspections after the first flight, at 15 hours, at 50 hours and at 100 hours. Do the SOAP procedure again after the first flight (added SOAP inspections at 15 hours, 50 hours, and 100 hours are optional). Do all corrective actions that are necessary.

NOTE: It is permitted for the engine to continue in service while an expedited SOAP analysis is done, if all other inspections are satisfactory.

(d) If an engine has windmilled for more than 60 minutes with more than 10 psi of continuous oil pressure after engine shutdown or engines that windmilled for any length of time with 10 psi or less oil pressure after shutdown, the operator must disassemble it for an Oil System Components examination.

NOTE: Oil System Components Examination includes a visual and dimensional examination of all Bearings (Main and Accessory), seals and gears in both the Engine and the Main Accessory Gearbox. Do a careful examination of the No. 2, 3, 4, and 5 bearings. Bearing cages must not show excessive wear. No ball or roller skidding, loss of hardness or shape because of overheating is permitted. Acceptable parts may be continued-in-service.

(2) Oil Pressure Interruption/Low Oil Pressure

CAUTION: ANY POWER OPERATION AT OR ABOVE IDLE WITH OIL PRESSURE OF 34 PSI OR LESS REQUIRES THE ENGINE TO BE DISASSEMBLED FOR AN OIL SYSTEM COMPONENTS EXAMINATION.

(a) Be careful to operate the engine with sufficient oil pressure.

J. Breather Pressure

(1) General

(a) Breather pressure is differential between gearbox internal pressure and pressure at gearbox breather discharge port.

(b) Prior to checking breather pressure, it is important to remove all hardware from the gearbox breather port, including the short breather outlet duct. Experience has shown that this duct affects the reading obtained and correction factors have been unreliable.

(2) Limits

(a) For JT8D-1,-1A,-1B,-7,-7A,-7B,-9,-9A engines without a No. 4 bearing carbon seal, the breather pressure must not be more than 3.9 psi (8.0 inch Hg).

(b) For JT8D-11,-15,-15A,-17,-17A,-17R,-17AR engines without a No. 4 bearing carbon seal, the breather pressure must not be more than 4.2 psi (8.5 inch Hg).

(c) For all engines with a No. 4 bearing carbon seal (incorporated in the original build or by SB 5250) the breather pressure must not be more than 3.5 psi (7.13 inch Hg).

NOTE: If breather pressure tests are done on an engine with continuous permanent recording equipment, it is permitted to continue this engine in service if it has a steady state limit of 3.5 psi (7.13 inch Hg) for no more than 30 seconds and the pressure level is

not more than 5 psi (10.18 inch Hg). It is necessary to put an engine accepted to this additional limit on watch and do a breather pressure check at each 50 cycle interval.

NOTE: Total breather pressure must not be more than 6.4 psi (13 inch Hg), that is, the back pressure caused by ducts attached to the breather vent must not be more than the difference between the engine breather pressure and 6.4 psi (13 inch Hg).

K. Fuel And Oil Leakage Limits

(1) Fuel or oil leakage from overboard drains, accessory drive seal drains, or No. 6 bearing sump is acceptable provided leakage is within the following limits:

Location	Fluid	Allowable Leakage
Gearbox Starter Drive Overboard Drain	Oil	10 cc/hr
Gearbox Hydraulic Pump Drive Overboard Drain	Oil	10 cc/hr
No. 4 Bearing Drain Tube (Engine Incorporating Carbon No. 4 Bearing Seal)	Oil	Oil leakage from drain tube at Idle power is normal.
Fuel Pump Drive Overboard Drain	Oil	10 cc/hr
Fuel Pump Drain	Fuel	60 cc/hr (Engine Running Or Shut Down)
Fuel Control Drain	Fuel	None
P Valve Drain	Fuel	1. 470 cc one time upon engine shutdown. 2. 60 cc maximum after engine shutdown. 3. 360 cc/hr maximum during engine running.

Location	Fluid	Allowable Leakage
(CONTINUED)		
		4. Engine incorporating plugged P &D valve drain per SB 3757: no leakage.
Combustion Chamber Drain	Fuel	1. No leakage with engine running. 2. 90 cc maximum one time upon engine shutdown. 3. 60 cc/hr maximum after engine shutdown (engine incorporating plugged P&D valve drain per SB 3757).
Combustion Chamber Drain And/Or Wet 1st Stage Turbine Vanes/Blades	Oil	

NOTE: Oil wetting on the 1st stage turbine vanes/blades sometimes can be described as an irregular radial pattern and streaks outward. Such indications if seen, can incorrectly be reported as cracks.

NOTE: Oil leakage from the Combustion Chamber Drain And/Or Wet 1st stage turbine vanes/blades is not permitted if the engine is Post SB A6196 - Improved No. 5 Bearing Oil Return and Compartment Sealing.

1. For engines without SB A5944/SB 6101 No. 4 and 5 Scavenge Oil Temperature Indicators Previously Installed:

A. Be sure that the condition observed is oil leakage and not fuel leakage.

B. Operate the

Location	Fluid Allowable Leakage
(CONTINUED)	engine at Idle for five minutes, then approximately Cruise power or 1.8 EPR for five minutes, then at Idle again for five minutes. Then shutdown. C. After engine shutdown, look for oil leakage from the combustion chamber drain (when it occurs, leakage usually starts 10 minutes of less after shutdown). D. Engine removal for repair is necessary if oil leakage from the combustion chamber drain is more than 40 drops (or 2.0 cc) per minute. If oil leakage from the drain is less than 40 drops (or 2.0 cc) per minute, the engine can return to service with these limits: (1) Do a breather pressure test (must be in limits) (2) Monitor engine oil consumption. If there is a sudden increase, or if consumption increases and continues to increase above the maximum value specified in this section, examine the engine to find the cause (include

Location	Fluid Allowable Leakage
(CONTINUED)	
	the above items in the inspection).
	(3) Monitor the main oil inlet temperature. (This temperature must be within Maintenance Manual limits).
	NOTE: 1. For engines with SB A5944/SB 6101 No. 4 and 5 Scavenge Oil Temperature Indicators Previously Installed:
	A. Be sure that the condition observed is oil leakage and not fuel leakage.
	B. Do a visual inspection of the No. 4 and 5 scavenge oil tenperature indicators as specified in SB A5944/SB 6101
	C. If indicator color has changed, do corrective action as specified in SB A5944/SB 6101.
	D. If indicator color did not change, return engine to service with these limits:
	(1) Monitor engine oil consumption. If there is a sudden increase, or if consumption increases and continues

Location	Fluid	Allowable Leakage
(CONTINUED)		
		to increase above the maximum value specified in this section, examine the engine to find the cause (include the above items in the inspection). (2) Monitor the main oil inlet temperature. (This temperature must be within Maintenance Manual limits). (3) Monitor the SB A5944/SB 6101 Indicators at the intervals given in SB A5944/SB 6101.
Exhaust Case - No. 6 Bearing Sump	Oil	Oil wetness not resulting in oil puddling within 20 minutes after engine shutdown.

Task 72-00-00-760-003:

3. Inspection Prior To Test

A. Fuel System Inspection

(1) Fuel System

(a) Visually check all fuel system tubes and components for security and leakage.

(b) Remove, clean if necessary and install the fuel pump filters.

(c) Remove, clean if necessary and install the fuel control filters.

(d) Check the fuel system for the presence of water.

(e) Service the fuel system with an approved fuel conforming to Specification SB 2016.

NOTE: The engine must be ground tested and trimmed using the same grade fuel as used for flight operations. Slight variations for any given lever position will result if alternate fuels are used.

B. Oil System

(1) Oil System Inspection.

(a) Remove, disassemble, clean, and reinstall the main oil strainer. See Section 72-61-00, Removal/Installation-00, and Section 72-61-53, Maintenance Practices-00. Replace filter if cartridge type.

(b) Visually check all of the oil system tubes and components for security and leakage.

(c) Fill the oil tank with an approved oil conforming to Specification 521 Synthetic Oil.

NOTE: Approved oils are listed in SB 238.

CAUTION: UP TO TWO GALLONS OF OIL MAY BE IN THE SCAVENGE SECTIONS; THEREFORE, OIL MUST NOT BE ADDED TO THE TANK UNTIL THE SCAVENGE SECTIONS ARE CLEARED. IF THE ABOVE PROCEDURE IS NOT FOLLOWED, EXCESSIVE OIL MAY BE ADDED WHICH WILL RESULT IN A BUILDUP OF SUFFICIENT INTERNAL PRESSURE TO RUPTURE THE TANK DURING ENGINE OPERATION.

(d) If oil is required after starting the engine, the engine shall be operated for approximately one minute at IDLE speed. This is required to make certain that any oil which may be in the scavenge section of the engine is returned to the tank, thereby assuring an accurate oil level check.

C. Electrical System Inspection

(1) Electrical system

(a) Check the ignition system components for security.

WARNING: BECAUSE THE VOLTAGE TO THE SPARK IGNITERS IS DANGEROUSLY HIGH, THE IGNITION SWITCH MUST BE IN THE "OFF" POSITION BEFORE REMOVAL OF ANY OF THE IGNITION SYSTEM COMPONENTS. APPROXIMATELY THREE MINUTES OF TIME MUST ELAPSE BETWEEN THE OPERATION OF THE IGNITION SYSTEM AND THE REMOVAL OF COMPONENTS WHEN A SPARK IGNITER LEAD IS DETACHED FROM A SPARK IGNITER, TOUCH THE END OF THE LEAD TO THE SHELL OF THE IGNITER TO DISSIPATE THE RESIDUAL ENERGY.

(b) Remove both spark igniters; check and reinstall.

D. Instrumentation System Inspection

(1) Instrumentation System

(a) Check engine instrumentation for security and general condition.

(b) Inspect the pressure sensing probes for security.

(c) Visually check all indicating thermocouples for security.

(d) Check the thermocouple harness and all lead insulations and shieldings for chafing and security.

E. Engine Controls Inspection

(1) Engine Controls

(a) Check the power lever for full travel, ease of movement and security.

NOTE: To prevent dilution of the bearing lubrication medium, protect the pre-packed bearings used in the power cross shaft assembly during any washing process. The same precautions must be taken when fuel lines near this assembly are disconnected and fuel is, or may be, in these lines.

(b) Inspect the compressor bleed valve, bleed valve control temperature sensing element and the air tube for security.

F. Run Up Area and Engine Inlet Duct Inspection

(1) Run Up Area and Engine Inlet Duct.

(a) Prior to starting the engine, the inlet must be thoroughly inspected and cleaned of possible loose nuts, bolts, tools and other objects which could cause engine damage and possible subsequent failure.

(b) Police the inlet and exhaust areas to ensure against the presence of foreign objects which could, under some circumstances, enter the engine.

Task 72-00-00-760-004:

4. Engine Test Procedure

A. Starting Procedure for Pneumatic and Combustion Starters

(1) Fuel Shutoff Lever - OFF.

CAUTION: DO NOT OPEN THE FUEL SHUTOFF LEVER BEFORE TURNING ON THE STARTER AND THE IGNITION.

(2) Power Lever - IDLE.

(3) Electrical Master Switch - ON.

(4) Fuel Supply Master Switch - ON.

NOTE: Fuel inlet pressure must be 5 psi minimum.

(5) Engine Starter Switch - ON.

NOTE: Check for oil pressure rise while cranking.

(6) Ignition switch - ON when N2 speed reaches 5 - 6.5 percent.

CAUTION: CHECK FOR ROTATION OF BOTH COMPRESSORS PRIOR TO TURNING IGNITION SWITCH ON.

(7) Fuel Control Shutoff Valve Lever - On when N2 tachometer indicates 15 percent minimum rpm (20 percent desired) and when an indication of N1 rotor rotation is observed.

CAUTION: LACK OF N1 ROTATION DURING START MAY RESULT IN ABNORMAL TURBINE SECTION TEMPERATURES WITH RESULTANT DAMAGE. IF N1 ROTATION IS NOT INDICATED DISCONTINUE START AND INVESTIGATE CAUSE. INSUFFICIENT AIR PRESSURE TO A PNEUMATIC STARTER OR TO A COMBUSTION STARTER THAT IS BEING USED AS A PNEUMATIC STARTER, MAY NOT SUPPLY ENOUGH STARTER TORQUE TO START AN ENGINE PROPERLY, RESULTING IN HOT, HUNG OR "TORCHING" STARTS. WHEN AIRBLEED FROM ANOTHER ENGINE IS USED TO OPERATE THE STARTER CAUTION IS NECESSARY TO ENSURE THAT THE OPERATING ENGINE IS TURNING OVER FAST ENOUGH TO PROVIDE AN ADEQUATE SUPPLY OF PRESSURIZED AIR TO THE ENGINE BEING STARTED. AN ENGINE SHOULD NEVER BE PERMITTED TO TAKE LONGER THAN 30 SECONDS TO ACCELERATE TO IDLE RPM. IN THE EVENT OF TORCHING, HIGHER THAN USUAL EXHAUST GAS STARTING TEMPERATURE, TOO LONG AN ACCELERATION TIME, OR OTHER ABNORMALITIES DISCONTINUE THE STARTING ATTEMPT AND INVESTIGATE.

(8) Release start switch at starter cut-out or 35 percent N2 rpm, whichever occurs first.

NOTE: A sudden recovery of pneumatic duct pressure occurs at starter cut-out.

(9) Turn off the ignition system.

NOTE: The ignition system cycle, for the particular equipment installed, must also be considered when making a succession of starts or starting attempts. For the single pack, 20-4 joule system, the cycle is two minutes ON - three minutes OFF; two minutes ON - twenty three minutes OFF. For the twin 20 joule system, the cycle is 10 minutes ON - 20 minutes OFF. For unsatisfactory starts, see paragraphs M and N.

If it is found necessary to clear the engine, see paragraph E for the proper procedure.

CAUTION: IF FUEL IS SHUT OFF INADVERTENTLY BY CLOSING FUEL SHUTOFF LEVER DO NOT REOPEN FUEL VALVE AGAIN IN ATTEMPT TO REGAIN "LIGHT". WHENEVER ENGINE FAILS TO LIGHT, SHUT OFF FUEL AND IGNITION AND CONTINUE TURNING COMPRESSOR OVER WITH STARTER FOR 10 - 15 SECONDS TO CLEAR OUT TRAPPED FUEL OR VAPOR. IF STARTER IS DISENGAGED, DO NOT ENGAGE THE STARTER AGAIN WHILE REAR COMPRESSOR ROTOR IS ROTATING, IN ORDER TO EXTEND STARTER LIFE AND REDUCE CHANGE OF FAILURE OF STARTER SHEAR SECTION OR ENGINE DRIVESHAFT. BEFORE ATTEMPTING ANOTHER START, ALLOW EITHER A 30 SECOND FUEL DRAINING PERIOD OR PRESCRIBED STARTER COOLING PERIOD, WHICHEVER IS LONGER.

CAUTION: IF ONLY ONE HALF OF THE TWIN PACK 20 JOULE SYSTEM IS USED FOR GROUND ENGINE START AND THE START IS UNSUCCESSFUL, THE ENGINE MUST BE CLEARED OF TRAPPED FUEL BEFORE ATTEMPTING ANOTHER START WITH THE OTHER HALF OF THE IGNITION SYSTEM.

(10) Ascertain that the engine accelerates normally to "IDLE" rpm and that the maximum allowable turbine discharge starting temperature, as noted in Engine Check Table, is not exceeded.

NOTE: For engines incorporating bleed system consisting of one 13th stage starting bleed and three 8th stage anti-surge bleed valves, ensure that starting bleed control valve (SBCV) has actuated. Once oil inlet temperature is indicated, slowly accelerate engine to 8000 rpm N2 rotor speed prior to stabilizing at idle. Thirteenth stage bleed closure will be indicated by sudden increase in N2 rotor speed.

B. Satisfactory Start

(1) A start is satisfactory if there are these conditions:

(a) Light up takes place within 20 seconds after the Fuel Control Shutoff Valve Lever is placed in the ON position.

(b) The engine accelerates to idle speed range. See Figure 504.

CAUTION: IF TRIMMING IS NECESSARY, TRIM TO THE IDLE N2 SPEED AS SPECIFIED BY AIRFRAME MANUFACTURER. DO NOT EXCEED MAXIMUM TORQUE LIMIT OF 7 LBS-INCHES ON TRIM SCREWS.

(c) The exhaust gas temperature does not exceed the starting temperature limits as indicated in the Engine Check Table during transition period to IDLE rpm.

NOTE: The 20 second time interval is an arbitrary value. The actual time to light is dependent upon the amount of torque supplied by the starter.

(d) Oil pressure is at least 40 psi.

(e) Exhaust gas temperature reduces to or below that temperature specified for IDLE as indicated in the Engine Check Chart after IDLE rpm has been obtained.

C. Unsatisfactory Start

(1) This condition is broken into three phases:

(a) Hot Start. Exhaust gas temperature exceeds the starting temperature limit as specified in the Engine Check Chart. A hot start can be anticipated by observing a greater initial, starting fuel flow than normal for a given field elevation at the instant the fuel control shutoff valve is placed in the ON position.

(b) No Start. The engine does not light up as evidence by no rise in exhaust gas temperature, no increase in fuel flow or no sound indicating that fuel has ignited.

CAUTION: UNDER ALL CONDITIONS, IF THE FUEL CONTROL SHUT-OFF VALVE LEVER IS INADVERTENTLY MOVED TO THE OFF POSITION, THERE WILL BE AN IMMEDIATE FLAME OUT. DO NOT REOPEN THE SHUTOFF VALVE AS IT WILL BE IMPOSSIBLE TO REGAIN THE LIGHT.

DURING GROUND OPERATION INTRODUCING UNBURNED FUEL INTO THE ENGINE CAN CREATE A FIRE HAZARD AND OVERHEATING OF THE ENGINE AND TAILPIPE AREA. THE NORMAL STARTING SEQUENCE MUST BE REPEATED FOR EACH STARTING ATTEMPT. CHECK BOTH ROTORS FOR FREEDOM OF ROTATION PRIOR TO STARTING.

(c) Hung Start. After "light up" has occurred, the rpm does not increase to that of IDLE, but remains at some lower point with the exhaust gas temperature at or below maximum starting limit.

D. Unsatisfactory Start Procedure

(1) The following procedure is used in case of an unsatisfactory start:

(a) Fuel Control Power Lever - IDLE.

(b) Fuel Control Shutoff Valve Lever - OFF.

(c) Ignition Switch - OFF.

(d) Engine Starter Switch - OFF.

(e) Fuel Supply Switch - OFF (When compressors stop rotating).

NOTE: Investigate to find the reason for the difficulty. If a satisfactory start cannot be accomplished, refer to the troubleshooting chart.

(f) A fuel drainage period of at least 30 seconds shall be allowed before another start is attempted.

NOTE: The engine coast down and subsequent motoring prior to the next start is usually sufficient to purge the engine of normal amounts of fuel admitted during an unsuccessful start.

E. Clear Engine Procedure

(1) This operation will be used whenever it is desired to clear the engine of trapped fuel or vapors.

(a) Fuel Control Power Lever - IDLE.

(b) Fuel Control Shutoff Valve Lever - OFF.

(c) Ignition Switch - OFF.

(d) Fuel System Supply Switch - ON.

(e) Engine Starting Switch - ON.

(f) Maintain engine rotation for 10 to 20 seconds.

(g) Engine Starting Switch - OFF.

(h) Fuel Supply Switch - OFF. (When compressors stop rotating).

F. Determination of Corrected N2 Speed
See Figures 505 and 506.

(1) The calculation for corrected N2 speed and the rotor speed factors are shown in Figures 505 and 506.

(2) JT8D engine experience indicates a recommended high rotor data plate speed deterioration limit of plus 1.9 % minus 0.8 % corrected RPM be established.

G. Max. Observed Exhaust Gas Temperature And Spread Check

(1) A check of the exhaust gas measurement system shall be made following a stabilization at take-off power. Remove four screws and cover from thermocouple cable junction box located at 6 o'clock on rear rail of turbine exhaust outer duct. Remove nine nuts, chromel bus bar and two leads. Position PWA 33907 Adapter on the studs and secure with nuts previously removed. Torque nuts to 15 - 18 lb-in. Connect the test stand temperature instrumentation harness to the PWA 33907 Adapter located on the engine alumel studs. Connect the test stand temperature instrumentation harness alumel lead to the engine alumel stud and secure with the previously removed nut. Torque the nut to 15 - 18 lb-in. Record readings from each Tt7 probe and calculate the maximum temperature spread between these readings.

(a) Tt7 temperature spread check across all probes must not be more than 230°F (127.8°C).

R (b) Maximum permitted Tt7 for a single probe reading
R is 110°F (61°C) more than the averaging harness
R reading.

R NOTE: The maximum probe-to-harnesss average
R limits are not applicable to JT8D-11 post
R SB 5455 or JT8D-15A,-17A,-17AR (these
R engines have a signal boost circuit in the
R averaging harness).

R (2) Remove PWA 33907 Adapter and put back the two leads,
R chromel bus bar and nine nuts. Torque the nuts to 15 -
R 18 lb-in. Install the junction box cover and attach it
R with screws.

H. Shutdown Procedure

(1) In any instance where the engine has been operated above approximately 85 percent N2 for periods exceeding one minute during the last five minutes prior to shutdown, the engine must be operated at below 85 percent N2 (preferably at IDLE) for a period of five minutes in order to facilitate uniform cooling of parts. This applies in particular to periods of prolonged operation at high N2 speeds during engine trimming. If an emergency stop from high power is necessary, both rotors must be checked for freedom of rotation just prior to restarting.

(2) The following steps shall be complied with when shutting down:

(a) Fuel Control Power Lever - IDLE.

(b) Allow time for the cooling period as described above.

(c) Fuel Control Shutoff Valve Lever - OFF.

NOTE: Fuel Control Shutoff Valve must not be placed in the OFF position when engine speed is above IDLE, except in emergencies.

(d) As the compressors and turbines decelerate after shutdown, ascertain by listening that they do so freely without evidence of rubbing and binding.

(e) Fuel Supply Switch - OFF.

NOTE: Do not turn the fuel supply switch OFF until the engine stops rotating. This will ensure that fuel remains in the lines and that the engine driven fuel pump is properly lubricated.

I. Anti-Surge Bleed Operation Limits
See Figure 507.

NOTE: See Test E - Ground Check for Bleed System Operation.

Task 72-00-00-760-005:

5. Repair Reference Table

A. General

(1) Repair/test reference table lists various repairs, replacements and reinstallations and corresponding test to be performed following these actions. When more than one maintenance action has been done, combine different features of two or more tests, eliminate duplication, and perform resultant test during one period of operation. Where multiple tests each require single power setting, higher power setting shall be used.

(2) In order to achieve high degree of accuracy, it is recom- mended that all tests be conducted in P&W approved indoor test facility previous to installing engine in aircraft. However, in cases where such test facility was not avail- able or if operator prefers to test engine on aircraft, test requirements are indicated in the Repair/Test Reference Table.

(3) It should be understood that quality of test data from an on-the-wing engine test may not be as accurate as data generated from indoor engine test facility. While quality of on-the-wing test data should be sufficient to determine if engine is acceptable, operator should be willing to sacrifice certain degree of troubleshooting or trend monitoring capability when relying on installed engine data.

UNITS REPLACED, REPAIRED OR REINSTALLED	TEST
Accessory Drive	A and see Note (1)
Anti-Icing Air Shutoff Actuator and Valve	**
Average Pressure Probe - PT7 (8 Required)	B
Carbon Seals - Main Bearing	F
Combustion Area Inspection	B
Combustion Chambers	B
Combustion Chamber Ducts	F
Combustion Chamber Inner Case	F
Combustion Chamber And Turbine Fan Ducts	C
Compressor Inlet Duct (Post-SB 5947, 5948, 5949)	A
Compressor Inlet Group	G, I
Compressor Inlet and Front Compressor Section	B, I
Compressor Intermediate Group	F
Constant Speed Drive/Alternator Drive Oil Seal	A
Differential Fluid Pressure Switch	C
Diffuser Group	F
Diffuser Outer Fan Duct Group	C
Eighth Stage Bleed Valve	E
Engine Exhaust Case Section	G
Engine Oil Tank	A
Engine Oil Tank Drain Valve	None
Fan Exhaust (Mixer) Rear Outer Duct	None
Fan Exhaust Outer Rear (Transition) Duct	None
Fan Exit Stator Segments	None
Fan And Turbine Exhaust Duct (Mixer)	None
First Or Second Stage Compressor (Fan) Blades	I
First Or Second Stage Compressor Disk And Blade Assembly (Fan)	G and see Note (4), I
First Stage Turbine Vanes (Through Hot Section With Turbines Installed)	B, H
First Stage Turbine Vanes (Turbines Removed)	F
Front Accessory Drive Group	A
Front Compressor Drive Turbine	F

R
R

UNITS REPLACED, REPAIRED OR REINSTALLED	TEST
Front Compressor Drive Turbine Group And Engine Exhaust Case Section Group	F
Front Compressor Drive Turbine Rotor And Stator Assembly	F
Front Compressor Rotor And Stator Assembly	G, I
Front Fan Case	A
Fuel Control (Replacement Fuel Control)	D, H
Fuel Control Condensation Trap	None
Fuel Control Main Filter	C
Fuel Deicing Air Shutoff Actuator And Valve	**
Fuel Deicing Heater Assembly	C
Fuel Nozzle And Support Assemblies	B, H
Fuel Manifold Assembly	B, H
Fuel/Oil Cooler	C see Note (5)
Fuel/Oil Cooler Bypass Valve	C see Note (5)
Fuel/Oil Cooler Inlet Tube	C see Note (5)
Fuel/Oil Cooler Outlet Sensing Tube	C See Note (5)
Fuel Pressurizing And Dump Valve	C and see Note (3)
Fuel Pressurizing And Dump Valve Strainer	C
Fuel Pump (Same Fuel Control)	B and see Note (2), H
Fuel Pump Drive Oil Seal	A
Fuel Pump Filter	C
Fuel Pump And Fuel Control Package (Different Fuel Control)	D and see Note (2), H
Gearbox Coupling (Constant Speed Drive)	A
Gearbox Deaerator Oil Seal	A
Hydraulic Pump Drive Oil Seal	A
Igniter Plug (2 Required)	*
Ignition Cable (2 Required)	*
Ignition Exciter	*
Main Accessory Gearbox Assembly (Same Fuel Control)	B
Main Accessory Gearbox Assembly (Same Fuel Control) (And Fuel Control Connecting Linkage)	B
Main Accessory Gearbox Group (Same Fuel Control)	B

R
R

UNITS REPLACED, REPAIRED OR REINSTALLED	TEST
Main Gearbox Drive Bevel Gearshaft And Bearings	B
Main Oil Filter/Strainer Element	C see Note (5)
Main Oil Pump	C see Note (5)
N1 Tachometer Drive Oil Seal	A
N2 Tachometer Drive Gearshaft Oil Seal	A
No. 1 Bearing	G, I
No. 1 Bearing Air Sealing Ring And Seal Assembly	G, I
No. 1 Bearing Oil Scavenge Pump	A
No. 2 Bearing	F
No. 2 Bearing Seal Assembly	G, I
No. 3 Bearing And Seal	F
No. 3 Bearing Support (Diaphragm)	F
No. 4 Bearing	F
No. 4 Bearing Breather Tubes	B
No. 4 Bearing Housing Tube/Seal	F
No. 4 Bearing Seal Assembly	F
No. 4 Bearing Sealing Ring	F
No. 4 And 5 Bearing Oil Scavenge Pump	F
No. 4 And 5 Bearing Oil Pressure And Scavenge Tubes/Seals	A
No. 4 1/2 Bearing, Seals And Seal Spacers	F
No. 5 Bearing And Seal Assembly	F
No. 6 Bearing And Seals	G, I
No. 6 Bearing Oil Scavenge Pump	A
Oil Filter Pressure Relief Valve	A
Oil Pressure Relief Valve Assembly	C see Note (1) and (5)
Power Lever Cross Shafts	B
Pressure Ratio Bleed Control	E
Rear Compressor And Diffuser Section	F
Rear Compressor Drive Turbine Rotor And Shaft Assembly	F
Rear Compressor Drive Turbine Group	F
Rear Compressor Exit Stator Assembly	F
Rear Compressor Through The Rear Compressor Drive Turbine Section	F
Rear Compressor Rotor And Stator Assembly	F
Rear Fan Case	G

R
R

UNITS REPLACED, REPAIRED OR REINSTALLED	TEST
Start Bleed Control Valve	E
Starter Drive Gearshaft Coupling	A
Starter Drive Oil Seal	A
Thermocouple - TT7 (8 Required)	None
Thermocouple Box And Cable Assembly - TT7	None
Total Pressure Probe - PT2	E
Tubing Fuel (Low Pressure)	A
Fuel (High Pressure)	C
Oil	A
Anti-Surge Bleed Valve	E
Turbine Exhaust Cone And Duct	None
Turbine Nozzle Group	F
Turbine Shaft Inner Heatshield Assembly	F
Turbine Shaft Outer Heatshield Assembly	F
13th Stage Bleed Valve	E
13th Stage Compressor Sealing Ring	F

*Aural Check Igniter Firing With Engine Not Running
**Observe Valve Position While Actuating Valve With Engine Not Running

Note (1): When engine oil pressure is required, adjust main oil pressure to 43 - 46 psig at Idle. See paragraph 8. 100°F (38°C) minimum oil temperature is recommended while adjusting oil pressure.

Note (2): After replacing fuel pump and performing engine test run, torque the fuel pump quick-disconnect nut again per Section 72-60-00, Inspection/Check-00, Reference 1102.

Note (3): During and after this test, carefully inspect for fuel leakage at fuel manifold inlet tube to P & D valve tube end fittings. No leakage is permitted. Fuel leakage at P & D valve overboard drain must not exceed 300cc per hour measured during engine run only.

Note (4): Refer to the location that follows for a 24 hour flyback time limit permitted before the breather pressure check is necessary:

Section 72-30-00, Maintenance Practices-00
(Task 72-30-00-420-001) for Front Compressor Rotor 1st stage fan and 2nd stage disk and blade

UNITS REPLACED, REPAIRED OR REINSTALLED	TEST
removal/installation.	

Note (5): Test A (Ground Check at Idle) is an option to Test C for leak check of these replaced parts, but Test A will not give the increased oil pressure that is typical during engine accelerations. If an oil leak problem is possible, use Test C (with the thrust level modification specified for leak check) to see if there are oil leaks.

Task 72-00-00-760-006:

6. Tests For Repaired Engines

NOTE: All test limits for engines without noise reduction equipment are also applicable to engine which will have noise reduction equipment during test.

A. When cleaning engines prior to tests, following precautions must be taken.

(1) Protect all prepacked bearings, such as cross-shaft or control rod linkage bearings.

CAUTION: IF FUEL LINES ARE TO BE DISCONNECTED, PREPACKED BEARINGS IN THE AREA MUST BE PROTECTED FROM ANY LOST FUEL.

(2) Protect pressure ratio bleed control.

(3) Protect silicone rubber shock mounts on oil tank and oil tank strap. Wash down area as soon as possible after washing with cleaning solution.

B. Test A - Ground Check at Idle

(1) Inspect and clean test area, engine, and engine operating components.

(2) Start Engine.

(3) Allow engine to run at IDLE for minimum of two minutes for oil system repair/replacement as required for oil temperature to reach 100°F (38°C).

(4) Shut down.

(5) Inspect engine for evidence of fuel and/or oil leaks. See "Fuel and Oil Leakage Limits".

C. Test B - Ground Check At Takeoff

(1) Inspect and clean engine test area.

(2) Start engine (when configured with start bleed control valve, ensure bleed closure).

(3) Operate engine at idle until readings have stabilized and oil temperature reaches minimum of 100°F (38°C).

(4) Advance power lever slowly to Takeoff EPR (Normal Takeoff for -17R,-17AR) specified by airframe manufacturer for ambient conditions.

(5) Stabilize for three minutes at Takeoff (Normal Takeoff for -17R,-17AR).

(6) Check that oil pressure, oil temperature and EGT are within limits of appropriate Engine Check Chart Tables 501 - 506.

(7) Retard power lever to IDLE and operate engine for five minutes. Check oil level.

(8) Shut down engine and perform normal engine inspection procedures as specified by airframe manufacturer, including oil filter inspection.

D. Test C - Ground Check at 3000 lb/hr Fuel Flow

(1) Inspect and clean test area, engine, and engine operating components.

(2) Start Engine (when configured with start bleed control valve, ensure bleed closure).

(3) Operate engine at idle until readings have stabilized and oil temperature reaches minimum of 100°F (38°C).

(4) Advance power lever as necessary until minimum of 3000 lb/hr of fuel flow is observed. Maintain for minimum of two minutes.

NOTE: If the test is used to do a leak check of engine components, after the engine is stable at Idle move the engine power level between Idle and

3000 lb/hr. more than one time. Let the engine become stable for 15 seconds at each power level. From 10 to 20 cycles between Idle and the 3000 lb/hr. point are recommended to complete this leak check.

(5) After completion of check, return power lever to IDLE.

(6) Shut down.

(7) Inspect engine for evidence of fuel and/or oil leaks. See "Fuel and Oil Leakage Limits".

E. Test D - Part Power Trim Check

(1) Inspect and clean test area, engine, and engine operating area.

(2) Start engine (when configured with bleed control start valve, ensure bleed closure).

(3) Run at IDLE for five minutes.

(4) Part Power Trim Setting. See Figure 508.

NOTE: For JT8D-1 and -1A engines that incorporate single position power lever stop, position power lever against part power trim stop, and adjust fuel control max. trim adjustment so that Pt7 is as determined from aircraft manufacturer's trim information.

NOTE: For other engines incorporating two position power lever stop (HSD Bulletin Code JFC60-1 No. 17) position power lever against Standard (S) or Cold (C) part power trim stop as specified by the aircraft manufacturer for the ambient temperature during trim. Adjust fuel control trim adjustment so that Pt7 is as determined from aircraft manufacturer's trim information.

(5) Exercise the control by moving the power lever three times in amounts sufficient to cause at least a 5 percent N2 speed change. Return the engine to the trim stop position and allow the engine to stabilize for at least three minutes. Record N2, thrust, PT2, and TT2.

NOTE: The idle and maximum speed trimmers affect each other, therefore, it is necessary to repeat the above procedure until the desired settings are obtained without intermediate adjustment.

(6) Remove the remote trimmers from the fuel control. Stabilize for five minutes with the power lever against the part power stop. Check the PT7 against the aircraft manufacturer's part power trim information. If this value is not acceptable, trim the control until an acceptable final trim check is made with the trimmers removed. After an acceptable final trim has been obtained, wire the part power trim stop in this stowed position.

CAUTION: IT SHOULD BE NOTED THAT WITH THE ENGINE TRIMMED AS DESCRIBED ABOVE AGAINST THE PART POWER TRIM STOP, TAKE-OFF THRUST RATING CAN BE OBTAINED WITH THE STOP IN THE STOWED POSITION BELOW THE FULL POWER LEVER POSITION. THE ENGINE SHOULD NOT BE RUN WITH THE POWER LEVER ADVANCED BEYOND THE POSITION REQUIRED TO OBTAIN THE TAKE-OFF Pt7 FOR THE INLET TEMPERATURE AT THE TIME AS DETERMINED FROM THE PROPER AIRCRAFT MANUFACTURER'S POWER SETTING INFORMATION. IF THIS RATING CANNOT BE OBTAINED PRIOR TO REACHING FULL POWER LEVER POSITION, RECHECK THE PART POWER TRIM.

(7) Availability of TAKE-OFF PT7 may be checked as follows:

(a) Determine TAKE-OFF PT7 using appropriate aircraft manufacturer's information.

(b) Advance power lever to position which gives TAKE-OFF PT7 as determined in (a) above. Run for three minutes at this position.

NOTE: When advancing power lever, check that operation of bleed valves is within limits of applicable curve.

(8) After engine has stabilized, check that all parameters are within limits of Tables 501 through 506, Engine Check Charts.

(9) Retard power lever to IDLE and operate engine for five minutes at this position.

(10) Shut down engine. Visually inspect engine for any discrepancies such as fuel or oil leaks. See "Fuel and Oil Leakage Limits", Paragraph 2.L.

(11) Fuel control trim screw re-centering procedure

(a) It can be necessary to set the Idle and Part Power trim screws to new positions and start the trim procedure again. It is possible that one of these causes will make this necessary:

1 No engine N2 response to either trim screw movement (with apparently no problem with the fuel control).

2 Malfunction of the trim equipment (this can put a trim screw at one of the stop positions).

3 Trim position unknown (which makes it necessary for the operator to start the procedure again).

(b) For information only, trim screw turns have these approximate results in the full range from stop to stop:

1 22 full turns (typical)

2 36 clicks per turn

3 792 clicks total range (typical)

4 One full turn of Part Power screw changes N2 approximately 225 rpm.

5 One full turn of Idle screw changes N2 approximately 155 rpm.

NOTE: The Part Power trim screw has an effect on both Part Power and Idle trim. The Idle screw has a very small or no effect on Part Power trim.

(c) Procedure

1 If during an engine run, do a shutdown procedure.

2 Turn the Idle and Part Power trim screws in a counterclockwise direction down to the bottom.

3 Turn the Idle and Part Power screws lightly in the clockwise direction ten (10) full turns (this will get the screws to the center of the trim range and make it possible to start the trim procedure again).

4 Start the engine again and go on with the trim procedure (refer to the airframe manufacturer's trim procedures).

F. Test E - Ground Check for Bleed System Operation

(1) Inspect and clean test area.

(2) Start engine (when configured with start bleed control valve, ensure bleed closure).

(3) Run at IDLE, until oil temperature reaches 38°C minimum.

(4) Slowly accelerate engine and record N1 speed at which anti- surge bleed valves close. Bleed closing is indicated by a sudden increase in EPR.

(5) Slowly decelerate engine from a stabilized point just above bleed valve closing and record N1 speed at which anti-surge bleed valves open. Bleed valve opening is indicated by a sudden decrease in EPR.

NOTE: Engine prior to SB 5425 bleed configuration will indicate EPR increment of approximately 0.05 at constant power lever position during anti-surge bleed actuation. Engine incorporating SB 5425 bleed configuration will indicate smaller EPR shift of approximately 0.02.

(6) Do a bleed valve opening and closing check by the limits in Figure 507, Anti-Surge Bleed Chart.

(7) Retard power lever to idle and shut down engine.

(8) Inspect engine for evidence of fuel and/or oil leaks. See "Fuel and Oil Leakage Limits".

(9) If the anti-surge bleed valves do not open and close as specified in Figure 507, refer to Task 72-00-00-810-006 Troubleshooting-04, "Surge."

G. Test F - Acceptance and Performance

(1) Instrumentation Required

(a) N1 - cockpit

(b) N2 - cockpit

(c) EGT - cockpit

(d) EPR - cockpit

(e) Fuel flow - cockpit

(f) Oil pressure - cockpit

(g) Oil temperature - cockpit

(h) PCP - external instrumentation - 0 - 200 psi range, measured at PCP fitting located on left side of engine diffuser case high pressure service bleed port near PS3 filter.

(i) PS4 - external instrumentation - 0 - 300 psi range, measured at PS4 fitting located on right side of engine diffuser case high pressure service bleed port at upper end of bleed valve actuation pressure supply line.

(j) PT7 - external instrumentation - 0 - 50 psi range, measured at PT7 line test fitting.

(k) Breather pressure - external instrumentation - 0 - 30 psi range. Refer to Paragraph H, Test G, Breather Pressure Check for installation.

(l) Ambient temperature - laboratory quality mercury thermometer

(m) Ambient pressure - local facilities such as airport control tower

(n) Install vibration pickups at locations indicated in Figure 509. Connect to vibration monitoring instrumentation, including low frequency (40 cps) filter.

NOTE: To ensure accuracy of PT7 system, pressure check system per Chapter/Section 77-11-01, Maintenance Practices-00. Also verify proper exhaust nozzle area as specified by airframe manufacturer.

(2) Test Procedure

NOTE: Engine bleed and electrical loads must be minimized during test. Fuel heater, generator, air conditioning packs, anti-icing and low pressure airbleed must be off. Generator cooling airbleed and hydraulic pumps shall be set at "low" or "no load" condition.

(a) Conduct engine part power and idle trim check per appropriate airframe manufacturer's Maintenance Manual adjustment/test procedures.

(b) Advance power lever slowly to Takeoff (Normal Takeoff for JT8D-17R, -17AR engines) EPR specified by airframe manufacturer for ambient conditions. During acceleration, check that operation of anti-surge bleed valves is within limits of Figure 507, Anti-Surge Bleed Chart, or applicable limits in airframe manufacturer's Maintenance Manual adjustment/test instructions. If bleed valve operation is outside limits of Figure 507, bleed control should be replaced and procedure repeated. Also during acceleration to Takeoff (Normal Takeoff for JT8D-17R, -17AR engine) monitor engine vibration. Stabilize for three minutes at Takeoff (Normal Takeoff for JT8D-17R, -17AR engines) EPR and record full set of readings per step (1).

(c) If testing a JT8D-17R or -17AR engine, perform a functional check of Reserve Takeoff Thrust System according to airframe manufacturer's instructions.

(d) Retard power lever to Part Power Trim EPR setting specified by airframe manufacturer. During deceleration monitor engine vibration, stabilize for three minutes at Part Power and then record full set of readings per step (1).

(e) Retard power lever to 1.65 EPR. During deceleration monitor engine vibration, stabilize for three minutes and then record full set of readings per step (1).

(f) Retard power lever to IDLE position. During deceleration, check that operation of anti-surge bleed valves is within limits of Figure 507 or equivalent figure in airframe manufacturer's Maintenance Manual adjustment/test instructions. Also monitor engine vibration during deceleration to Idle.

(g) Conduct functional check of Reverse Thrust System according to airframe manufacturer's Maintenance Manual adjustment/test instructions.

(h) Conduct a ground acceleration time check using procedure specified by airframe manufacturer. If none is specified by airframe manufacturer, conduct ground acceleration time check per following instructions:

1 Set idle N2 speed as specified by airframe manufacturer for ambient conditions. Stabilize for 70 seconds.

2 Determine 99 percent of Takeoff N2 from step (b).

CAUTION: **THERE IS NO POWER LEVER STOP AT** TAKEOFF RATING. DURING ENGINE OPERATION AT TAKEOFF RATING (NORMAL TAKEOFF FOR JT8D-17R,-17AR ENGINES), **EXHAUST GAS TEMPERATURE, N1 AND N2 RPM MUST BE CLOSELY MONITORED TO ENSURE THAT OPERATING LIMITATIONS ARE** NOT EXCEEDED.

3 Perform snap acceleration by movement of power lever to full forward position in not more than one second. Record response time from initial power lever movement to 99 percent of Takeoff (Normal Takeoff for JT8D-17R,-17AR engines) N2 and immediately retard power lever to Takeoff (Normal Takeoff for JT8D-17R,-17AR engines) EPR. Acceleration time shall not exceed Acceleration Time Check Curve, Figure 510.

(3) Test Limits

(a) Do a check of corrected N1 vs. EPR by Figure 511. This curve is designed to make sure that the EPR system operates accurately. During Takeoff and Part Power, record N1 speed, EPR and Tt2 at Part Power and Takeoff (Normal Takeoff for JT8D-17R,-17AR engines) after the engine becomes stable. Compare the corrected N1 to Figure 511.

1 Engines which plot within limits of Figure 511 are acceptable if all other operating limits are met.

2 Engine plotting above limits of Figure 511 should be investigated for the cause of the high N1. Troubleshooting may include:

a Leak check PT7 indicating system

b Inspect fan for FOD, blended blades

c Check N1 indication system

d Waterwash engine per airframe manufacturer's instructions

e If none of the items a through d reduced high N1 condition but all other operating limits are met, engine is acceptable. However high N1 condition may result in N1 redline limiting situation on hot days.

3 If an engine has a plot less than the limits of Figure 511, do a check for N1 indicating system problems. If the N1 indicating system is not the cause of the low N1 speed, and all other engine operating limits are correct, the engine is acceptable.

(b) EGT shall be within recommended limits as specified in Figure 512, for appropriate engine model.

(c) Oil pressure and oil temperature shall not exceed limits as specified in Table 501 through Table 506, Engine Check Charts.

(d) Ratio of PCP/PS4 shall not exceed limits of Figure 512, Turbine Cooling Air Check Curve, for appropriate engine model.

(e) Breather pressure shall not exceed limits specified in Paragraph 2.K.(2), Breather Pressure Limits.

(f) Vibration shall not exceed limits given in Tables 507, 508, and 509.

NOTE: If vibration exceeds limits, it is permitted to balance an engine on-wing to reduce vibration levels.

H. Test G - Breather Pressure Check

(1) Introduction

(a) Air leakage into the bearing compartments is what causes an engine's breather pressure. What is good and necessary about breather pressure is that it keeps oil scavenge pump operation satisfactory during all phases of engine operation, specially at low power. But too much air leakage (the result of which is high breather pressure) is not accepted and can cause operational problems which can include No. 4 and 5 bearing compartment oil fires and uncontained events.

(b) If the engine's breather pressure is monitored, this can identify an operational problem before it causes an event. Oil Consumption Monitoring and No. 4 and 5 Bearing Compartment Scavenge Oil Temperature Monitoring (SB A5944 and 6101) are also available to help identify operational problems and prevent uncontained events.

(c) It is important to obey the procedures in this section to make sure that the readings gotten from these checks are accurate and the same from one check to another. This is important when it is necessary to make a decision about engine procedures for which a breather pressure check will be necessary. If accurate readings are not gotten, this can cause maintenance which is not necessary, and it will not be possible to identify and correct a problem before it causes an undesirable event.

(2) General

(a) A breather pressure check is used to find the breather flow across the deoiler in the main gearbox.

(b) Breather pressure is the differential pressure between the gearbox total (static and dynamic) internal pressure (measured at the LV3 port) and the static pressure measured at the gearbox breather discharge (LB2 port).

NOTE: It is technically necessary to measure the pressure at these two points (LV3 and LB2) in the system to find the flow across the deoiler (breather pressure). See Figure 514 for a diagram of the breather flow across the deoiler and the points on the gearbox where the differential pressure is measured.

(c) Breather discharge is a mixture of air and engine oil.

(3) Methods And Options

(a) There are three methods to measure the breather pressure flow across the deoiler, and some are more accurate than others:

1 Oil tank cap gage

2 LV3 port

3 LV3 and LB2 ports

(b) There are also two options for read-out devices:

1 Gage

2 Transducer and digital readout device

(4) Instrumentation

(a) Method 1 (oil tank cap gage)

1 With this method a pressure gage is connected to PWA 33784 Oil Tank Cap installed on the oil tank filler neck as shown in Figure 515 (Sheet 1).

NOTE: This is the least accurate method, and the results from this method can be breather pressure readings that are a small percentage higher than those in Method 2 or 3. If Method 1 is used, it will be necessary to do the test again with a more accurate method if the reading is near to or higher than the limits specified.

(b) Method 2 (gage at LV3 port)

1 With this method a gage is connected to the LV3 port on the gearbox. See Figure 515 (Sheet 2). This method is more accurate than Method 1 (gage connected to an oil tank cap tool) but not as accurate as Method 3 (differential pressure gage connected to LV3 and LB2). The result of Method 2 will be readings that are lower than those with Method 1 but higher than those with Method 3.

(c) Method 3 (differential pressure gage)

1 With this method a differential pressure gage is connected to the LB2 port (low pressure) and the LV3 port (high pressure). See Figure 515 (Sheet 2). This is the most accurate method. The result of this method will be the lowest breather pressure readings. This method is the most accurate because it correctly measures breather flow as a differential pressure. It is permitted to use an optional transducer with leads to a digital readout device.

NOTE: It is permitted to use the optional transducer and digital readout device in Method 1 or 2 also.

(5) Engine and equipment preparation

(a) With Method 1, 2, or 3 it is necessary to use the precautions to make sure that the readings are accurate and consistent:

1. The accuracy and range of a gage are important. A 0 - 5 psi (for engines with carbon-type No. 4 bearing seal) or 0 - 10 psi (for engines with labyrinth-type No. 4 bearing seal) calibrated gage is satisfactory. A gage with a smaller range (0 - 3 psi) can be more accurate and easier to read (this is important when lower breather pressure limits for engines with carbon seals are specified). A wide-sweep gage that is accurate ± one percent of the reading is suggested. A pressure transducer and digital display (readout device) is the most accurate and the easiest to read. The transducer and digital readout device together must have a minimum accuracy of ± one percent of the reading.

2. Lines from the gearbox connections must be straight, go upward to the gage or transducer,and be as short as possible (this to let the oil contained in the breather air flow back into the gearbox). If there is a low point in the line, oil can collect during engine operation and cause a blockage of the low (compared to other pressures) pressure signal to the gage. Short line lengths also keep internal air resistance of these lines to a minimum.

3. If an airframe-provided breather duct (attached to the LB2 port) is installed, it will be necessary to remove it because the restriction from this duct will increase the reading from the LB2 port. See Figure 515 (Sheet 1).

   NOTE: There are correction factors available for the breather duct, but these factors are usually not accurate.

4. When the gage and lines are not used and are in storage, it will be necessary to keep the gage higher than the opposite (gearbox connection) end of the lines (this is to let the oil drain out of the lines). Loose caps (or other covers) on the ends of the lines will keep unwanted material out of the lines, but it will be necessary to let oil drain from the lines.

5 With Method 1, 2, or 3, the breather pressure reading recorded during the check must be the highest reading during slow acceleration to Takeoff power and the two-minute stabilization period that follows. It is therefore important (if a maximum-indication gage is not used) to monitor the gage continuously during the slow acceleration and stabilization periods.

6 Use the same method in subsequent breather pressure checks to keep check results approximately the same from one check to another (and to make it possible to compare results accurately). It is therefore important to use one method of instrumentation and always use the same method in subsequent checks. Relative breather pressure reading differences between methods are not large (estimated at less than 10 percent in all), but for engines that are near the maximum limits (and for engines with a trend toward deterioration), this difference can be important.

(6) Instrumentation installation

NOTE: Refer to the paragraph above about recommended gage range and accuracy.

(a) Method 1

1 Remove the oil tank cap from the oil tank filler neck. Refer to the Inspect Oil Level, Change Oil, And Change Filter/Strainer paragraph in Inspection/Check-01.

2 Install PWA 33784 Cap on the oil tank filler neck with the usual cap installation procedures. If necessary install a calibrated gage or an optional pressure transducer and digital readout device to the fitting on the tool cap with a short, straight line to the gage or transducer/readout device above the cap. See Figure 515 (Sheet 1).

3 Attach the line and gage or transducer/readout device to protect it from vibration.

(b) Method 2

1 Disconnect the airframe oil pressure vent line (if used) from the LV3 fitting on the gearbox.

2 Install a calibrated gage or an optional pressure transducer and digital readout device to the LV3 fitting on the gearbox.

3 Attach the line and gage or transducer/readout device to protect it from vibration.

(c) Method 3

1 Install a locally-fabricated adapter to the LB2 port on the gearbox to hold a fitting for the low-pressure side of a differential pressure gage.

NOTE: JT8D-200 series engines use a PN 5000091-01 No. 2 bearing tube connector. Use this tube connector (or a similar adapter) installed on the LB2 port of the gearbox to attach the low-pressure gage fitting (refer to SB 6428 for a modification to put longer studs on the LB2 port pad). See Figure 515A for a view of the tube connector.

2 Connect the low-pressure side of a calibrated gage or a pressure transducer and digital readout device to the open fitting on the No. 2 bearing connector (or similar tool adapter) with a short, straight line.

3 Disconnect the airframe oil pressure vent line (if used) from the LV3 fitting on the gearbox.

4 Connect the high-pressure side of a calibrated gage or an optional pressure transducer and digital readout device to the LV3 port on the gearbox.

5 Attach the lines and gage or transducer/readout device to protect them from vibration.

(7) Engine test procedure

(a) Examine and clean the test area.

WARNING: USE ALL APPLICABLE SAFETY PRECAUTIONS AROUND AN ENGINE DURING OPERATION (REFER TO ENGINE GROUND SAFETY PRECAUTIONS AT THE START OF THIS SECTION). USE EAR PROTECTION AND STAY AWAY FROM ENGINE HAZARD AREAS.

(b) Start the engine and operate it at Idle for five minutes.

CAUTION: IF A MAXIMUM-INDICATION TYPE GAGE IS NOT USED, IT WILL BE NECESSARY TO MONITOR THE GAGE CONTINUOUSLY DURING THE SLOW ACCELERATION OF THE ENGINE TO TAKEOFF AND DURING THE TWO-MINUTE STABILIZATION PERIOD THAT FOLLOWS. IF THE PRESSURE GOES TO A MAXIMUM VALUE AND THIS IS NOT SEEN, AN ENGINE COULD GO BACK INTO SERVICE WITH A BAD SEALING PROBLEM IN A BEARING COMPARTMENT.

(c) Do a slow acceleration (in approximately 60 seconds) to Takeoff power. This slow acceleration is necessary to prevent a possible breather pressure which is more than limits (overshoot) and is not seen on the gage.

(d) After the engine becomes stable at Takeoff (two minutes minimum), record the maximum breather pressure seen during the slow acceleration and stabilization period. Bring the engine power back to Idle.

(e) Compare the recorded breather pressure reading with the maximum limit in this section (Paragraph 2.J.(2). If Method 1 was used and the reading is less than 10 percent from the limit, do the test again with Method 2 or 3 test equipment.

(f) Do an engine cool-down run and then a shutdown procedure (refer to Engine Test Procedure in this section).

(g) Remove the test equipment and install all removed engine fittings.

WARNING: DO NOT CONTINUE AN ENGINE IN SERVICE IF IT HAS HIGH BREATHER PRESSURE. HIGH BREATHER PRESSURE SHOWS THAT THERE IS LEAKAGE OF HIGH-TEMPERATURE AIR INTO BEARING COMPARTMENTS. THIS CAN CAUSE A POSSIBLY DANGEROUS SITUATION.

(h) If the breather pressure is not in limits, do an investigation and corrective actions where necessary. Remove the engine and (if necessary) disassemble the engine to correct the problem.

I. Test H - Acceleration Check

(1) Inspect and clean engine test area.

(2) Start engine.

(3) Set idle N2 speed as specified by airframe manufacturer for ambient conditions. Stabilize for 70 seconds.

(4) Advance power lever slowly to Takeoff (Normal Takeoff for JT8D-17R,-17AR engines) EPR specified by airframe manufacturer for ambient conditions. Stabilize for one minute and record full set of readings. Determine 99 percent of Takeoff (Normal Takeoff for -17R,-17AR) N2. Set the Idle N2 speed specified by the airframe manufacturer for the ambient conditions. Let the engine become stable for five minutes.

CAUTION: THERE IS NO POWER LEVER STOP AT TAKEOFF RATING. DURING ENGINE OPERATION AT TAKEOFF RATING (NORMAL TAKEOFF FOR JT8D-17R,-17AR ENGINE), EXHAUST GAS TEMPERATURE, N1 AND N2 RPM MUST BE CLOSELY MONITORED TO ENSURE THAT OPERATING LIMITATIONS ARE NOT EXCEEDED.

(5) Perform snap acceleration by movement of power lever to full forward position in not more than one second. Record response time from initial power lever movement to 99 percent of Takeoff (Normal Takeoff for JT8D-17R,-17AR engine) N2 and immediately retard power lever to Takeoff (Normal Takeoff for JT8D-17R,-17AR engine) EPR. Acceleration time must not exceed Acceleration Time Check Curve, Figure 510.

(6) Retard power lever to idle.

(7) Shut down engine.

J. Test I - Vibration Check

NOTE: Engines may be trim balanced on wing to reduce vibration levels. See Inspection/Check-02, On Wing Trim Balancing.

(1) Install vibration pickups at locations indicated in Figure 509. Connect pickups to vibration monitoring instrumentation, including low frequency filter (40 CPS).

(2) Inspect and clean test area.

(3) Start engine.

(4) Operate engine at Idle until readings have stabilized and oil temperature reaches a minimum of 100°F (38°C).

(5) Make a slow (two to three minute) acceleration from Idle to Takeoff EPR (Normal Takeoff for -17R,-17AR) as specified by airframe manufacturer for ambient conditions. Monitor inlet and rear case vibration during acceleration. Record peak observed inlet and rear case vibration amplitudes and N1 and N2 RPM at which they occur.

(6) Stabilize 30 seconds at Takeoff EPR (Normal Takeoff for -17R,-17AR).

(7) Retard power lever slowly (two to three minutes) to Idle. Monitor inlet and rear case vibration during deceleration. Record Peak inlet and rear case vibration amplitudes and N1 and N2 RPM at which they occur.

(8) If vibration limits of Tables 508 and 509 are exceeded during transients, steady state vibration must be recorded at approximately the speed which produced peak vibration to determine if vibration is acceptable to the limits of Tables 508 and 509.

NOTE: Peak vibration is understood to be the highest moderately steady meter reading after the engine has stabilized for 30 seconds and should not include momentary flickering of indicators. All over limit vibration conditions must be wave analyzed to establish which engine rotor is causing the vibration. The above vibration

procedure shall be followed for all vibration surveys (manual or automatic).

(9) Shut down engine.

(10) Peak vibration shall not exceed limits in Tables 508 and 509.

Task 72-00-00-760-007:

7. Engine Deterioration Ground Check (For Installations Not Equipped With In-Flight Monitoring)

A. Procedure

(1) Prior to each hot section inspection (see Section 72-40, Combustion Section - Maintenance Practices) perform following ground check to detect engine deterioration.

	Overall Vibration Limits (Except as Noted)	
Pickup Location	Single Amplitude	Double Amplitude
INLET SECTION		
Below 60.5% N1	0.0041 Inch (4.1 mils)*	0.0082 Inch (8.2 mils)*
60.5% N1 and above	0.0035 Inch (3.5 mils)	0.007 Inch (7.0 mils)
High Rotor Frequency	0.0025 Inch (2.5 mils)**	0.005 Inch (5.0 mils)**
REAR SECTION		
Below 60.5% N1	0.003 Inch (3.0 mils)	0.006 Inch (6.0 mils)
60.5% N1 and above	0.003 Inch (3.0 mils)	0.006 Inch (6.0 mils)

Maximum Vibration Limits
Table 507

Overall Vibration Limits (Except as Noted)

Pickup Location	Single Amplitude	Double Amplitude
High Rotor Frequency	0.002 Inch (2.0 mils)**	0.004 Inch (4.0 mils)**

CAUTION: THIS TABLE GIVES RED LINE VIBRATION LIMITS DURING TEST. IF LIMITS ARE EXCEEDED, THE INDICATED CORRECTIVE ACTION MUST BE TAKEN. THESE LIMITS DO NOT CONSTITUTE ACCEPTANCE LIMITS. (REFER TO TABLE 508 AND TABLE 509).

*Engines which exceed this limit may experience excessive low turbine rotor airseal rub. Therefore engine should be removed and low turbine airseals should be inspected.

**The disposition of No. 3 bearings exceeding this limit should be based on their exposure to high rotor vibration. Therefore if engine is removed for exceeding vibration limits, the amplitude and duration of the excessive vibration should be documented.

Maximum Vibration Limits
Table 507 (Continued)

Pickup Location	Overall Vibration Limits Single Amplitude	Double Amplitude
INLET SECTION Both No. 1 and No. 6 Non-Oil Damped	0.0025 In. (2.5 mils)	0.005 In. (5.0 mils)
INLET SECTION Both No. 1 and No. 6 Oil Damped	0.002 In. (2.0 mils)	0.004 In. (4.0 mils)
REAR SECTION	0.0015 In. (1.5 mils)	0.003 In. (3.0 mils)

NOTE: These limits are valid only when vibration pickups are mounted at locations specified per Figure 509 and only when the low frequency filter (40 CPS) is selected in the vibration monitoring circuit.

Repaired Acceptance Limits
Reference Vibration Levels
Table 508

Pickup Location	Overall Vibration Limits Single Amplitude	Double Amplitude
INLET SECTION Both No. 1 & No. 6 Non-Oil Damped	0.0035 In. (3.5 mils)	0.007 In. (7.0 mils)
INLET SECTION* Both No. 1 & No. 6 Oil Damped	0.0025 In. (2.5 mils)	0.005 In. (5.0 mils)
REAR SECTION	0.0020 In. (2.0 mils)	0.004 In. (4.0 mils)

*IDLE to 58.2% N1

NOTE: These limits are valid only when vibration pickups are mounted at locations specified per Figure 509 and only when the low frequency filter (40 CPS) is selected in the vibration monitoring circuit.

Repaired Acceptance Peak Vibration Limits In 46.5% To 58.2% N1 Range
Table 509

(2) The following instrumentation is necessary for ground check:

(a) Absolute pressure gage to indicate thirteenth stage air pressure (Ps4). Special fitting is provided on right-hand side of engine at upper end of bleed valve actuation pressure supply line near high pressure (diffuser) service bleed point. Calibrated accuracy of gage should be ± 1.0 inch Hg absolute in range between 300 and 350 inches Hg absolute. Maximum instrument requirement is 500 inches Hg absolute.

NOTE: This measurement will indicate Ps4 only when operating above bleed valve actuation point dictated by pressure ratio bleed control.

(b) Laboratory quality mercury thermometer to indicate ambient temperature.

(c) Local facilities (such as airport control tower) for indicating barometric pressure.

(d) Absolute pressure gage to indicate Pt7. Calibrated accuracy of gage should be ± 0.5 inch Hg absolute in range between 0 and 100 inches Hg absolute.

(e) Instrumentation to check Pt7 and EGT and provide comparison with cockpit instrumentation of EPR (Pt7/Pt2) and EGT. If cockpit EGT instrumentation and accurate null-balance test instrumentation cannot be read simultaneously, EGT may be measured at stabilized condition with test instrument and then with cockpit instrument circuit under same stabilized conditions. Respective readings should then be compared. As alternate method, cockpit instrument system may be calibrated with standard test equipment designed for this purpose.

(3) Use following test procedure:

(a) With all nonessential aircraft airbleed and electrical systems shut off, set engine thrust to EPR (Pt7/Pt2) of 1.65. Erratic performance of Pt2 probe in center engine of Boeing 727 under static conditions necessitates use of Pt7/Pbar in place of EPR when setting thrust for engine at this position.

(b) Warm up engine for five minutes and reset thrust to EPR of 1.65 as required.

(c) Read and record following:

1 Pt7
2 EPR (aircraft instrument)
3 Ps4
4 EGT (accurate null-balance instrument)
5 EGTS (aircraft instrument)
6 Percent N1 (aircraft instrument)
7 Percent N2 (aircraft instrument)
8 Ambient temperature
9 Barometric pressure

(d) Use applicable table, Figure 518 or Figure 519 to process data. Repair consisting of water flushing of compressor or replacement of first stage turbine nozzle guide vanes, combustion chambers, transition ducts, turbine outer air seals, fuel nozzles, etc. may be necessary if test reveals any of following:

1 Reduction of 3.5 percent Ps4/Pt2 relative to new engine acceptance test, last complete overhaul, or last repair in which first stage nozzle guide vane area was rebuilt within overhaul manual limits.

2 Corrected TT7 of 860°F (460°C) maximum for JT8D-1,-1A,-1B,-7,-7A,-7B,-9,-9A, and -11 engines; 887°F (475°C) maximum for JT8D-15,-15A engines and 896°F (480°C) for JT8D-17,-17A,-17R, and -17AR engines.

3 There is -100 rpm (-0.82 percent tachometer) N2/T2 relative to data plate N2 rpm.

Task 72-00-00-760-008:

8. Oil Pressure Adjustment

See Figure 520.

A. Engine Preparation

(1) Ensure that engine has been properly serviced and is ready for operation.

(2) Start engine and run at IDLE for two to five minutes, to stabilize power level and allow oil temperature to reach 100°F (38°C) minimum.

B. Pressure Relief Valve Adjustment

CAUTION: WHEN REMOVING OUTER PLUG, DO NOT ALLOW INNER PLUG OR VALVE HOUSING TO TURN. LOSS OF OIL AND LOSS OF VALVE SECURITY CAN RESULT FROM LOOSENING OF THESE PARTS.

CAUTION: AFTER THE OIL PRESSURE IS ADJUSTED, MEASURE THE THREAD PROTRUSION DIMENSION AS SHOWN IN THE FIGURE. IF THIS DIMENSION IS NOT IN LIMITS, THERE CAN BE PROBLEMS IN THE OIL SYSTEM WHICH WILL MAKE TROUBLESHOOTING NECESSARY.

(1) Hold pressure relief valve inner plug hex firmly with wrench and remove outer plug.

NOTE: Cut lockwire from outer plug only; lockwire from inner plug to valve housing and from valve housing to gearbox should be left intact.

(2) Hold adjusting screw stationary with screwdriver and loosen locknut. If desired, fabricate valve adjusting tool from 7/16 inch deep socket with angled handle welded to side to allow screwdriver to pass through center. Such a tool will allow turning locknut while holding adjusting screw stationary.

(3) Use the screwdriver to adjust the oil pressure to 43 - 46 psig (test cell indication) with the engine at Idle power. Clockwise rotation will increase pressure; counterclockwise rotation will decrease pressure.

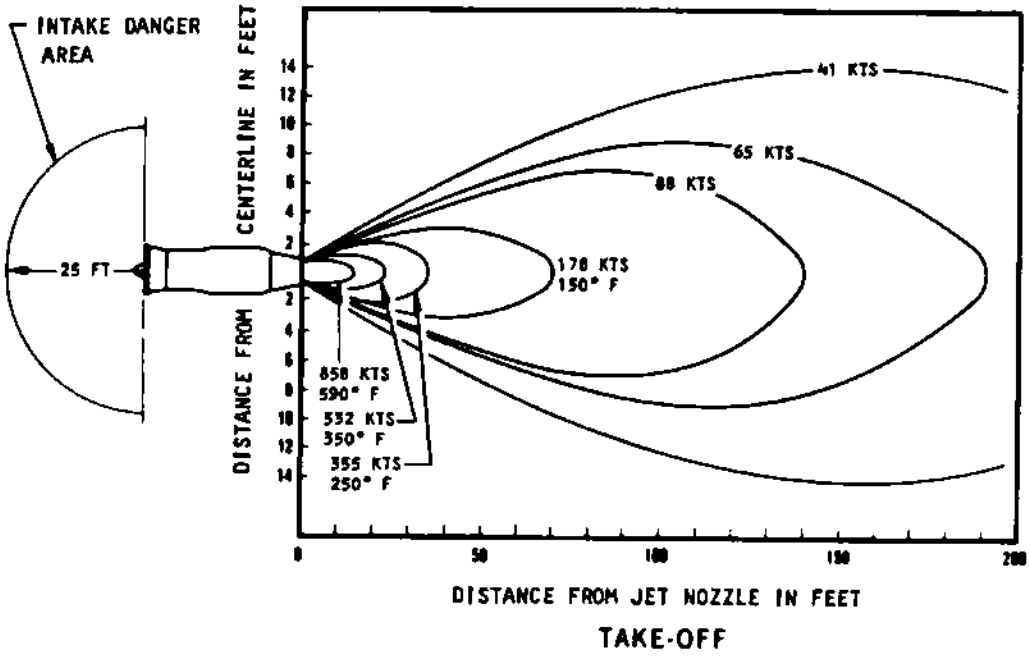
NOTE: One full turn of adjusting screw will change pressure approximately two psi.

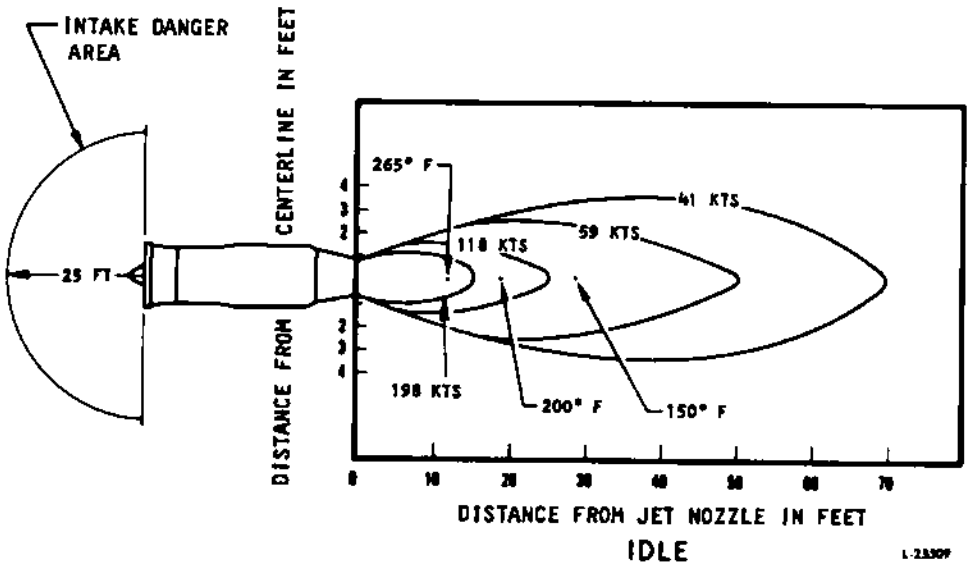
(4) Hold adjusting screw steady and torque locknut. See tool description in step (2).

(5) Measure the thread protrusion height as shown in the figure. This dimension must not be less than 0.280 inch (see the Caution above).

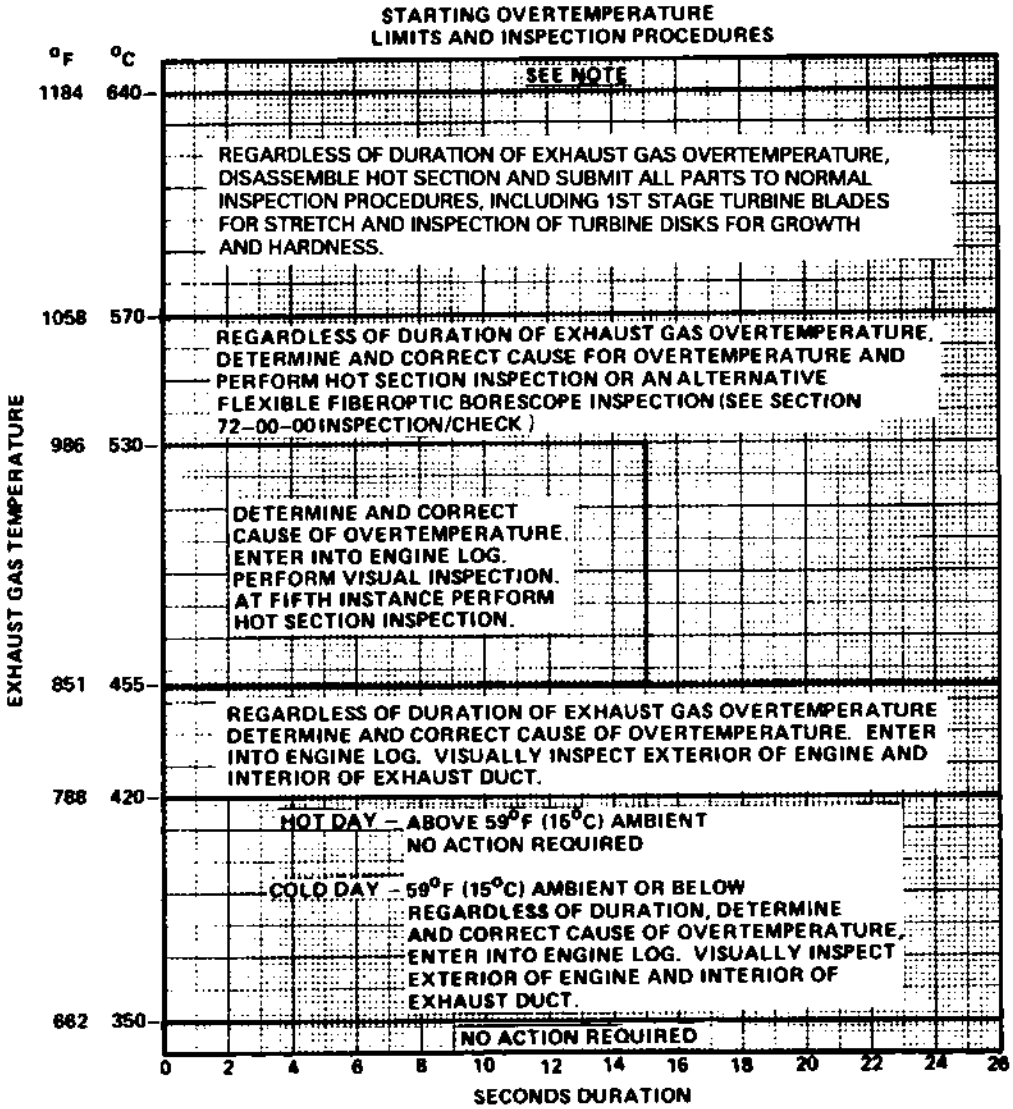
(6) Install outer plug, with a new packing lubricated with PWA 36500 lubricant, and torque to Section 72-61-51, Inspection/Check-00, "Fits and Clearances," Reference 1476. Lockwire outer plug to inner plug.

JT8D TURBOFAN ENGINE HAZARD AREAS





JT8D Turbofan Engine Hazard Areas
Figure 501
(Task 72-00-00-760-008)


STARTING OVERTEMPERATURE
LIMITS AND INSPECTION PROCEDURES
°F
°C
1184
640
SEE NOTE
REGARDLESS OF DURATION OF EXHAUST GAS OVERTEMPERATURE, DISASSEMBLE HOT SECTION AND SUBMIT ALL PARTS TO NORMAL INSPECTION PROCEDURES, INCLUDING 1ST STAGE TURBINE BLADES FOR STRETCH AND INSPECTION OF TURBINE DISKS FOR GROWTH AND HARDNESS.
1058
570
REGARDLESS OF DURATION OF EXHAUST GAS OVERTEMPERATURE, DETERMINE AND CORRECT CAUSE FOR OVERTEMPERATURE AND PERFORM HOT SECTION INSPECTION OR AN ALTERNATIVE FLEXIBLE FIBEROPTIC BORESCOPE INSPECTION (SEE SECTION 72-00-00 INSPECTION/CHECK)
986
530
DETERMINE AND CORRECT CAUSE OF OVERTEMPERATURE. ENTER INTO ENGINE LOG. PERFORM VISUAL INSPECTION. AT FIFTH INSTANCE PERFORM HOT SECTION INSPECTION.
851
455
REGARDLESS OF DURATION OF EXHAUST GAS OVERTEMPERATURE DETERMINE AND CORRECT CAUSE OF OVERTEMPERATURE. ENTER INTO ENGINE LOG. VISUALLY INSPECT EXTERIOR OF ENGINE AND INTERIOR OF EXHAUST DUCT.
788
420
HOT DAY – ABOVE 59°F (15°C) AMBIENT
NO ACTION REQUIRED
COLD DAY – 59°F (15°C) AMBIENT OR BELOW
REGARDLESS OF DURATION, DETERMINE AND CORRECT CAUSE OF OVERTEMPERATURE, ENTER INTO ENGINE LOG. VISUALLY INSPECT EXTERIOR OF ENGINE AND INTERIOR OF EXHAUST DUCT.
662
350
NO ACTION REQUIRED
EXHAUST GAS TEMPERATURE
0
2
4
6
8
10
12
14
16
18
20
22
24
26
SECONDS DURATION

L-89760 (0102)

Overtemperature Limits And
Inspection Procedures For
JT8D-1 And -7 (Starting)
Figure 502 (Sheet 1)
(Task 72-00-00-760-008)

NOTE: For exhaust gas temperature in excess of 1184°F (640°C) regardless of duration perform the following:

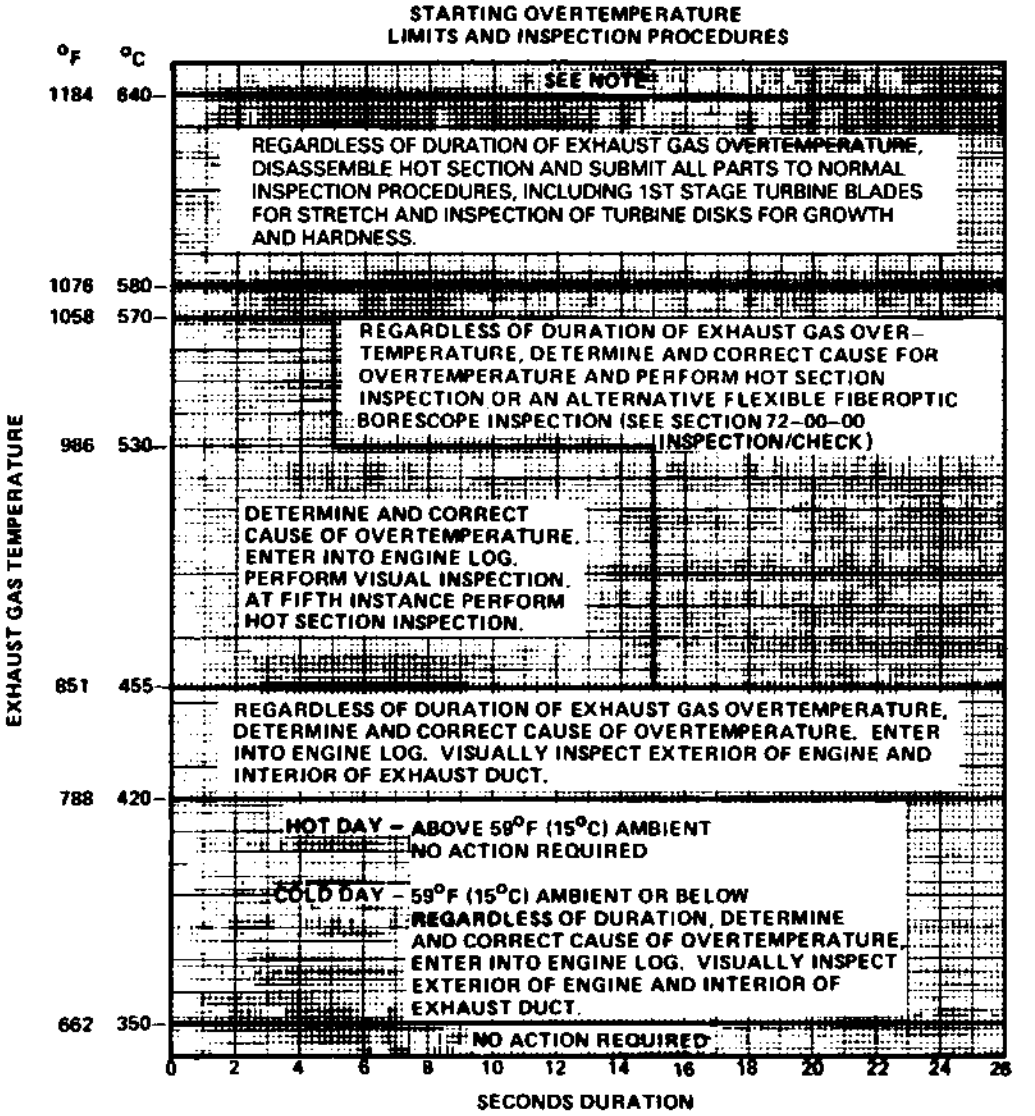
A. 1184° - 1256°F (640° - 680°C): Scrap all 1st stage turbine blades of materials other than PWA 663, PWA 1455 or PWA 1447. Determine metal temperature of PWA 663, 1455 or PWA 1477 1st stage turbine blades by optical metallurgical examination; blades which have not exceeded 2000°F (1093°C) metal temperature may be reused if they meet all other inspection criteria. Scrap blades which have exceeded 2000°F (1093°C) metal temperature; all other parts may be reused if inspection criteria are met (including turbine disk growth and hardness inspection).

B. 1256° - 1346°F (680° - 730°C): Same as A. above, plus examine 2nd stage turbine vanes directly behind several combustion chamber positions for metal temperature. Scrap vanes exposed to temperature in excess of 2000°F (1093°C).

C. 1346° - 1500°F (730° - 815°C): In addition to B. above, examine 2nd stage turbine blades and 3rd stage turbine vanes directly in line with several combustion chamber positions. Scrap parts exposed to temperature in excess of 2000°F (1093°C).

D. In excess of 1500°F (815°C): Same as A. above, but check all turbine blades and vanes for metal temperature. Scrap all parts exposed to temperature in excess of 2000°F (1093°C).

Key to Figure 502 (Sheet 1)


STARTING OVERTEMPERATURE
LIMITS AND INSPECTION PROCEDURES
°F
°C
EXHAUST GAS TEMPERATURE
1184
640
SEE NOTE
REGARDLESS OF DURATION OF EXHAUST GAS OVERTEMPERATURE, DISASSEMBLE HOT SECTION AND SUBMIT ALL PARTS TO NORMAL INSPECTION PROCEDURES, INCLUDING 1ST STAGE TURBINE BLADES FOR STRETCH AND INSPECTION OF TURBINE DISKS FOR GROWTH AND HARDNESS.
1076
580
1058
570
REGARDLESS OF DURATION OF EXHAUST GAS OVER-TEMPERATURE, DETERMINE AND CORRECT CAUSE FOR OVERTEMPERATURE AND PERFORM HOT SECTION INSPECTION OR AN ALTERNATIVE FLEXIBLE FIBEROPTIC BORESCOPE INSPECTION (SEE SECTION 72-00-00 INSPECTION/CHECK)
986
530
DETERMINE AND CORRECT CAUSE OF OVERTEMPERATURE. ENTER INTO ENGINE LOG. PERFORM VISUAL INSPECTION. AT FIFTH INSTANCE PERFORM HOT SECTION INSPECTION.
851
455
REGARDLESS OF DURATION OF EXHAUST GAS OVERTEMPERATURE, DETERMINE AND CORRECT CAUSE OF OVERTEMPERATURE. ENTER INTO ENGINE LOG. VISUALLY INSPECT EXTERIOR OF ENGINE AND INTERIOR OF EXHAUST DUCT.
788
420
HOT DAY - ABOVE 59°F (15°C) AMBIENT
NO ACTION REQUIRED
COLD DAY - 59°F (15°C) AMBIENT OR BELOW
REGARDLESS OF DURATION, DETERMINE AND CORRECT CAUSE OF OVERTEMPERATURE, ENTER INTO ENGINE LOG. VISUALLY INSPECT EXTERIOR OF ENGINE AND INTERIOR OF EXHAUST DUCT.
662
350
NO ACTION REQUIRED
0
2
4
6
8
10
12
14
16
18
20
22
24
26
SECONDS DURATION

L-89761 (0102)

Overtemperature Limits And
Inspection Procedures For
JT8D-1A,-7A And -9 (Starting)
Figure 502 (Sheet 2)
(Task 72-00-00-760-008)

NOTE: For exhaust gas temperature in excess of 1184°F (640°C) regardless of duration perform the following:

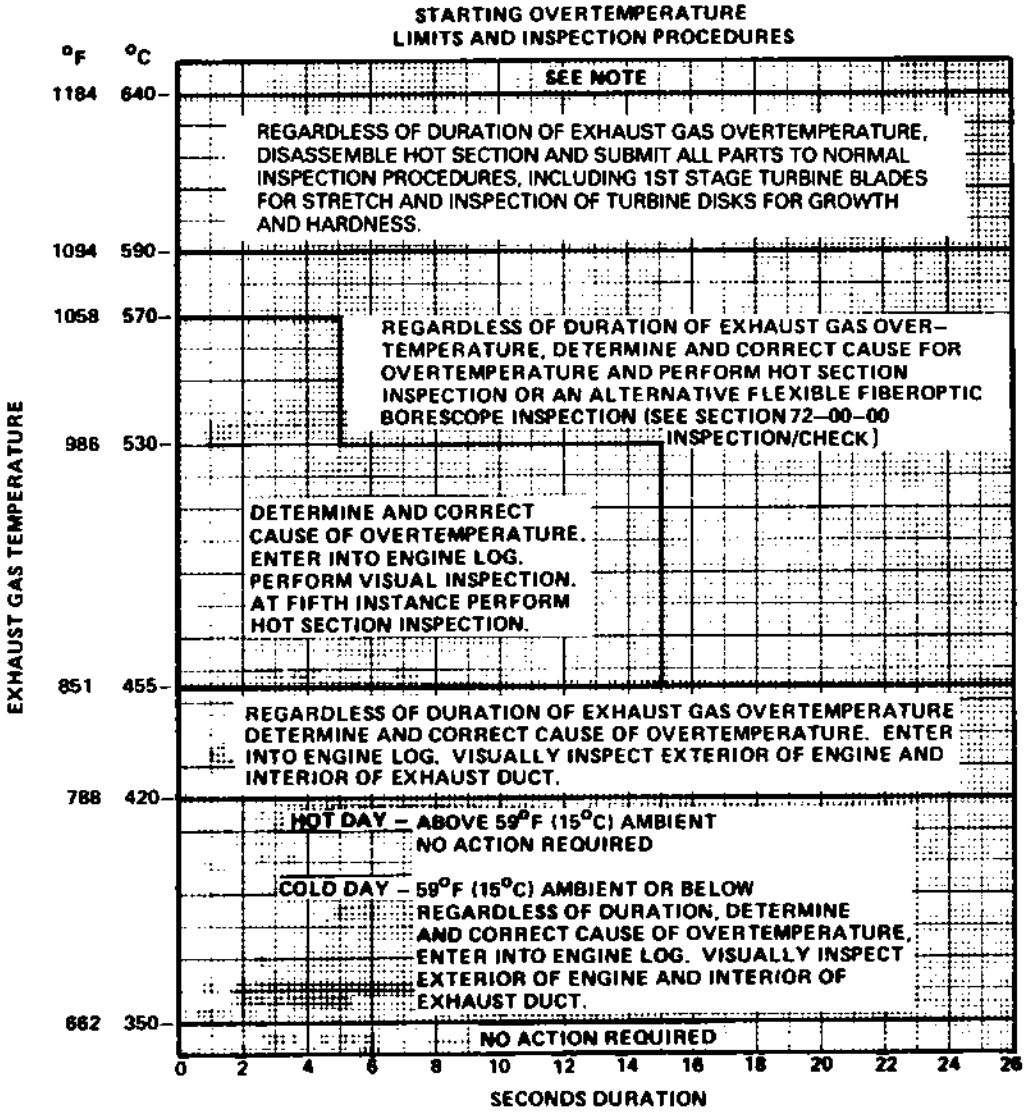
A. 1184° - 1256°F (640° - 680°C): Scrap all 1st stage PWA 1455 turbine blades of materials other than PWA 663, or PWA 1447. Determine metal temperature of PWA 663, 1455 or PWA 1477 1st stage turbine blades by optical metallurgical examination; blades which have not exceeded 2000°F (1093°C) metal temperature may be reused if they meet all other inspection criteria. Scrap blades which have exceeded 2000°F (1093°C) metal temperature; all other parts may be reused if inspection criteria are met (including turbine disk growth and hardness inspection).

B. 1256° - 1346°F (680° - 730°C): Same as A. above, plus examine 2nd stage turbine vanes directly behind several combustion chamber positions for metal temperature. Scrap vanes exposed to temperature in excess of 2000°F (1093°C).

C. 1346° - 1500°F (730° - 815°C): In addition to B. above, examine 2nd stage turbine blades and 3rd stage turbine vanes directly in line with several combustion chamber positions. Scrap parts exposed to temperature in excess of 2000°F (1093°C).

D. In excess of 1500°F (815°C): Same as A. above, but check all turbine blades and vanes for metal temperature. Scrap all parts exposed to temperature in excess of 2000°F (1093°C).

Key to Figure 502 (Sheet 2)


STARTING OVERTEMPERATURE
LIMITS AND INSPECTION PROCEDURES
°F
°C
1184
640
1094
590
1058
570
986
530
851
455
788
420
662
350
EXHAUST GAS TEMPERATURE
SEE NOTE
REGARDLESS OF DURATION OF EXHAUST GAS OVERTEMPERATURE, DISASSEMBLE HOT SECTION AND SUBMIT ALL PARTS TO NORMAL INSPECTION PROCEDURES, INCLUDING 1ST STAGE TURBINE BLADES FOR STRETCH AND INSPECTION OF TURBINE DISKS FOR GROWTH AND HARDNESS.
REGARDLESS OF DURATION OF EXHAUST GAS OVER-TEMPERATURE, DETERMINE AND CORRECT CAUSE FOR OVERTEMPERATURE AND PERFORM HOT SECTION INSPECTION OR AN ALTERNATIVE FLEXIBLE FIBEROPTIC BORESCOPE INSPECTION (SEE SECTION 72-00-00 INSPECTION/CHECK)
DETERMINE AND CORRECT CAUSE OF OVERTEMPERATURE. ENTER INTO ENGINE LOG. PERFORM VISUAL INSPECTION. AT FIFTH INSTANCE PERFORM HOT SECTION INSPECTION.
REGARDLESS OF DURATION OF EXHAUST GAS OVERTEMPERATURE DETERMINE AND CORRECT CAUSE OF OVERTEMPERATURE. ENTER INTO ENGINE LOG. VISUALLY INSPECT EXTERIOR OF ENGINE AND INTERIOR OF EXHAUST DUCT.
HOT DAY - ABOVE 59°F (15°C) AMBIENT
NO ACTION REQUIRED
COLD DAY - 59°F (15°C) AMBIENT OR BELOW
REGARDLESS OF DURATION, DETERMINE AND CORRECT CAUSE OF OVERTEMPERATURE, ENTER INTO ENGINE LOG. VISUALLY INSPECT EXTERIOR OF ENGINE AND INTERIOR OF EXHAUST DUCT.
NO ACTION REQUIRED
0
2
4
6
8
10
12
14
16
18
20
22
24
26
SECONDS DURATION

L-89762 (0102)

Overtemperature Limits And
Inspection Procedures For
JT8D-1B,-7B, And -9A (Starting)
Figure 502 (Sheet 3)
(Task 72-00-00-760-008)

NOTE: For exhaust gas temperature in excess of 1184°F (640°C) regardless of duration perform the following:

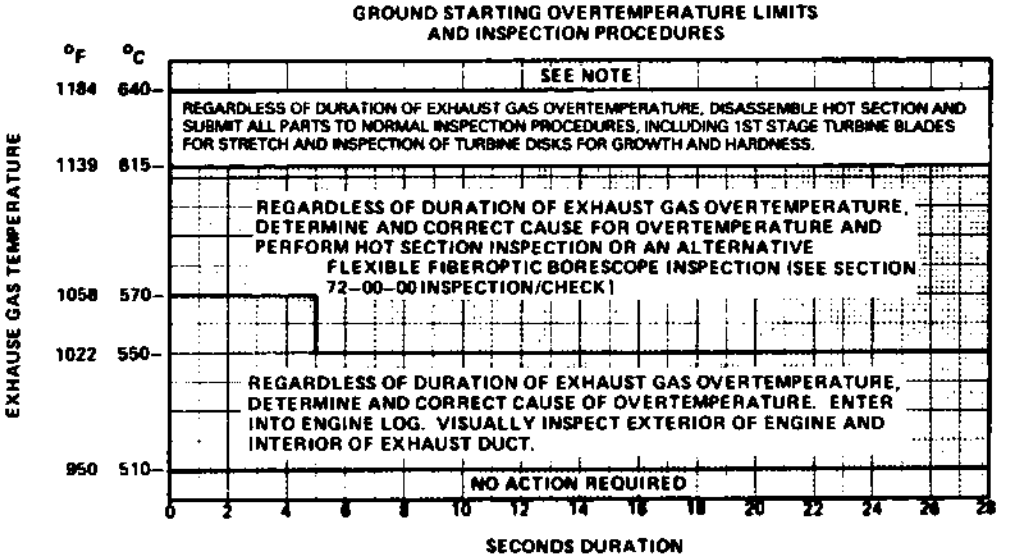
A. 1184° - 1256°F (640° - 680°C): Scrap all 1st stage turbine blades of materials other than PWA 663, PWA 1455 or PWA 1447. Determine metal temperature of PWA 663, 1455 or PWA 1477 1st stage turbine blades by optical metallurgical examination; blades which have not exceeded 2000°F (1093°C) metal temperature may be reused if they meet all other inspection criteria. Scrap blades which have exceeded 2000°F (1093°C) metal temperature; all other parts may be reused if inspection criteria are met (including turbine disk growth and hardness inspection).

B. 1256° - 1346°F (680° - 730°C): Same as A. above, plus examine 2nd stage turbine vanes directly behind several combustion chamber positions for metal temperature. Scrap vanes exposed to temperature in excess of 2000°F (1093°C).

C. 1346° - 1500°F (730° - 815°C): In addition to B. above, examine 2nd stage turbine blades and 3rd stage turbine vanes directly in line with several combustion chamber positions. Scrap parts exposed to temperature in excess of 2000°F (1093°C).

D. In excess of 1500°F (815°C): Same as A. above, but check all turbine blades and vanes for metal temperature. Scrap all parts exposed to temperature in excess of 2000°F (1093°C).

Key to Figure 502 (Sheet 3)



Overtemperature Limits And
Inspection Procedures For JT8D-11
(Ground Starting) (Pre-SB 5455)
Figure 502 (Sheet 4)
(Task 72-00-00-760-008)

NOTE: For exhaust gas temperature in excess of 1184°F (640°C) regardless of duration perform the following:

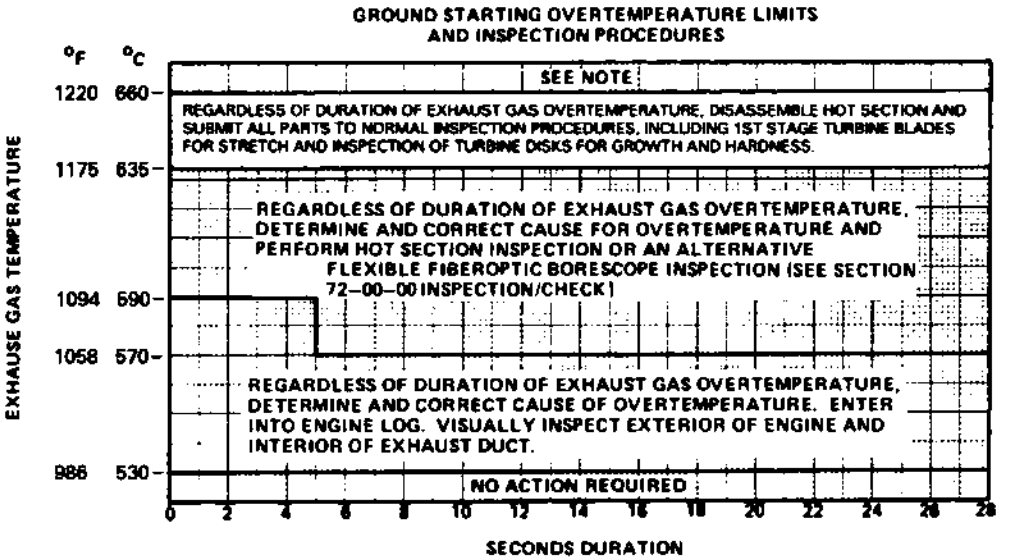
A. 1184° - 1256°F (640° - 680°C): Determine metal temperature of 1st stage turbine blades by optical metallurgical examination; blades which have not exceeded 2000°F (1093°C) metal temperature may be reused if they meet all other inspection criteria. Scrap blades which have exceeded 2000°F (1093°C) metal temperature; all other parts may be reused if inspection criteria are met (including turbine disk growth and hardness inspection).

B. 1256° - 1346°F (680° - 730°C): Same as A. above, plus examine 2nd stage turbine vanes directly behind several combustion chamber positions for metal temperature. Scrap vanes exposed to temperature in excess of 2000°F (1093°C).

C. 1346° - 1500°F (730° - 815°C): In addition to B. above, examine 2nd stage turbine blades and 3rd stage turbine vanes directly in line with several combustion chamber positions. Scrap parts exposed to temperature in excess of 2000°F (1093°C).

D. In excess of 1500°F (815°C): Same as A. above, but check all turbine blades and vanes for metal temperature. Scrap all parts exposed to temperature in excess of 2000°F (1093°C).

Key to Figure 502 (Sheet 4)



L-H7262 (0506)

Overtemperature Limits And
Inspection Procedures For JT8D-11
(Ground Starting) (Post-SB 5455)
Figure 502 (Sheet 5)
(Task 72-00-00-760-008)

NOTE: For exhaust gas temperature more than 1220°F (660°C) regardless of duration do these operations:

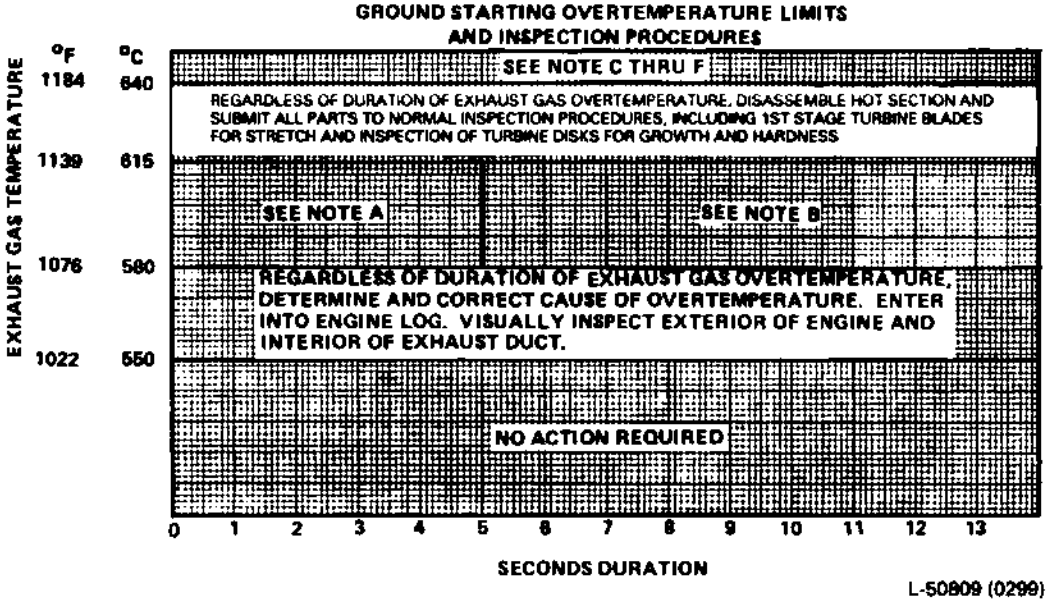
A. 1220° - 1292°F (660° - 700°C): Determine metal temperature of 1st stage turbine blades by optical metallurgical examination; blades which did not go to 2000°F (1093°C) metal temperature can continue-in-service if all other inspection criteria are in limits. Scrap blades which were at more than 2000°F (1093°C) metal temperature. All other parts can continue-in-service if all inspection criteria are in limits (this includes turbine disk growth and hardness inspection).

B. 1292° - 1382°F (700° - 750°C): Same as A. above, also examine 2nd stage turbine vanes directly behind several combustion chamber positions for metal temperature. Scrap vanes which were at a temperature more than 2000°F (1093°C).

C. 1382° - 1535°F (750° - 835°C): In addition to B. above, examine 2nd stage turbine blades and 3rd stage turbine vanes directly in line with several combustion chamber positions. Scrap parts which were at a temperature more than 2000°F (1093°C).

D. More than 1535°F (835°C): Same as A. above, but do a metal temperature check of all turbine blades and vanes. Scrap all parts which were at a temperature more than 2000°F (1093°C).

Key to Figure 502 (Sheet 5)



Overtemperature Limits
And Inspection Procedures
For JT8D-15,-17, And
-17R (Ground Starting)
Figure 502 (Sheet 6)
(Task 72-00-00-760-008)

NOTE: For exhaust gas temperature in excess of 1184°F (640°C) regardless of duration perform the following:

A. For a duration of five seconds or less regardless of exhaust gas overtemperature, determine and correct the cause of the overtemperature. Perform a thorough flexible type borescope inspection of the combustion area and high and low pressure turbine areas. Pay particular attention to the blades and vanes. Enter into the engine log. Visually inspect the exterior of the engine and the interior of the exhaust duct.

B. For a duration exceeding five seconds regardless of exhaust gas overtemperature, determine and correct cause for the overtemperature and perform a hot section inspection or an alternative flexible fiberoptic borescope inspection (See Section 72-00-00, Inspection/Check-01 (Task 72-00-00-210-003)).

For exhaust gas temperature in excess of 1184°F (640°C) regardless of duration perform the following:

C. 1184° - 1256°F (640° - 680°C): Determine metal temperature of 1st stage turbine blades by optical metallurgical examination; blades which have not exceeded 2000°F (1093°C) metal temperature may be reused if they meet all other inspection criteria. Scrap blades which have exceeded 2000°F (1093°C) metal temperature; all other parts may be reused if inspection criteria are met (including turbine disk growth and hardness inspection).

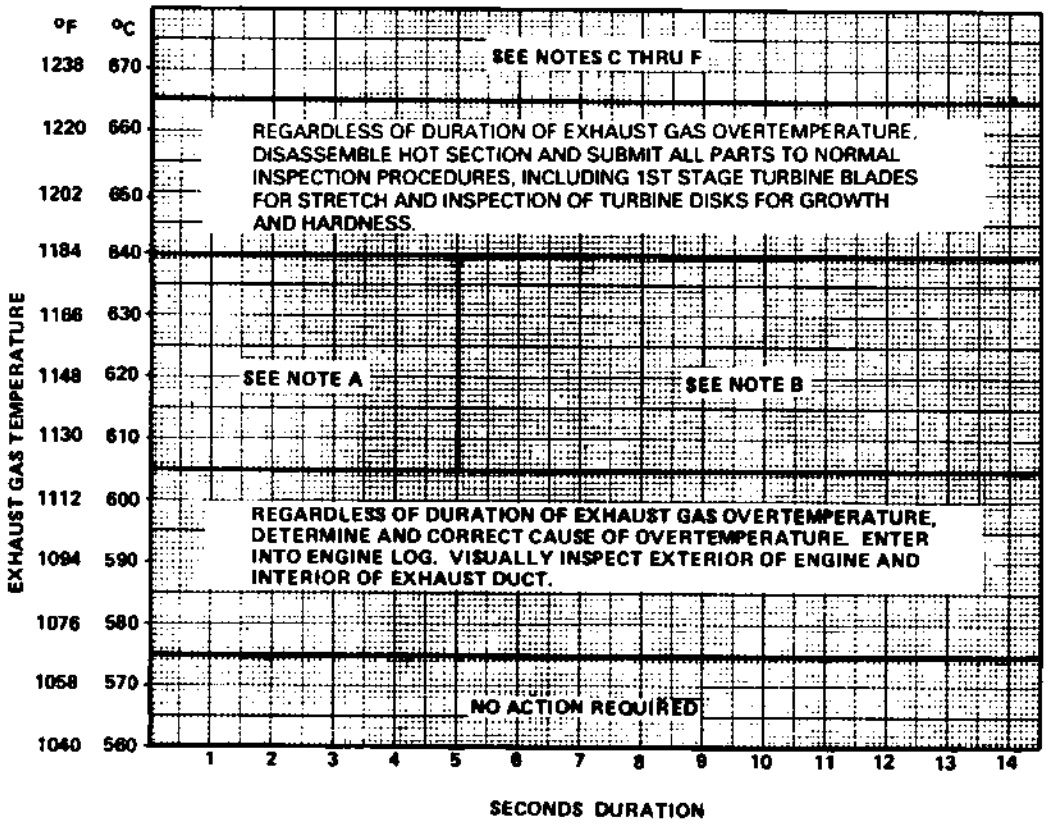
D. 1256° - 1346°F (680° - 730°C): Same as C. above, plus examine 2nd stage turbine vanes directly behind several combustion chamber positions for metal temperature. Scrap vanes exposed to temperature in excess of 2000°F (1093°C).

Key to Figure 502 (Sheet 6)

E. 1346° - 1500°F (730° - 815°C): In addition to D. above, examine 2nd stage turbine blades and 3rd stage turbine vanes directly in line with several combustion chamber positions. Scrap parts exposed to temperature in excess of 2000°F (1093°C).

F. In excess of 1500°F (815°C): Same as A. above, but check all turbine blades and vanes for metal temperature. Scrap all parts exposed to temperature in excess of 2000°F (1093°C).

GROUND STARTING OVERTEMPERATURE LIMITS AND INSPECTION PROCEDURES



L-84610 (0299)

Overtemperature Limits
And Inspection Procedures
For JT8D-15A,-17A, And
-17AR (Ground Starting)
Figure 502 (Sheet 7)
(Task 72-00-00-760-008)

NOTE: A. For a duration of five seconds or less regardless of exhaust gas overtemperature, determine and correct the cause of the overtemperature. Perform a thorough flexible type borescope inspection of the combustion area and high and low pressure turbine areas. Pay particular attention to the blades and vanes. Enter into the engine log. Visually inspect the exterior of the engine and the interior of the exhaust duct.

B. For a duration exceeding five seconds regardless of exhaust gas overtemperature, determine and correct cause for the overtemperature and perform a hot section inspection or an alternative flexible fiberoptic borescope inspection (See Section 72-00-00, Inspection/Check-01).

For exhaust gas temperature in excess of 1229°F (665°C) regardless of duration perform the following:

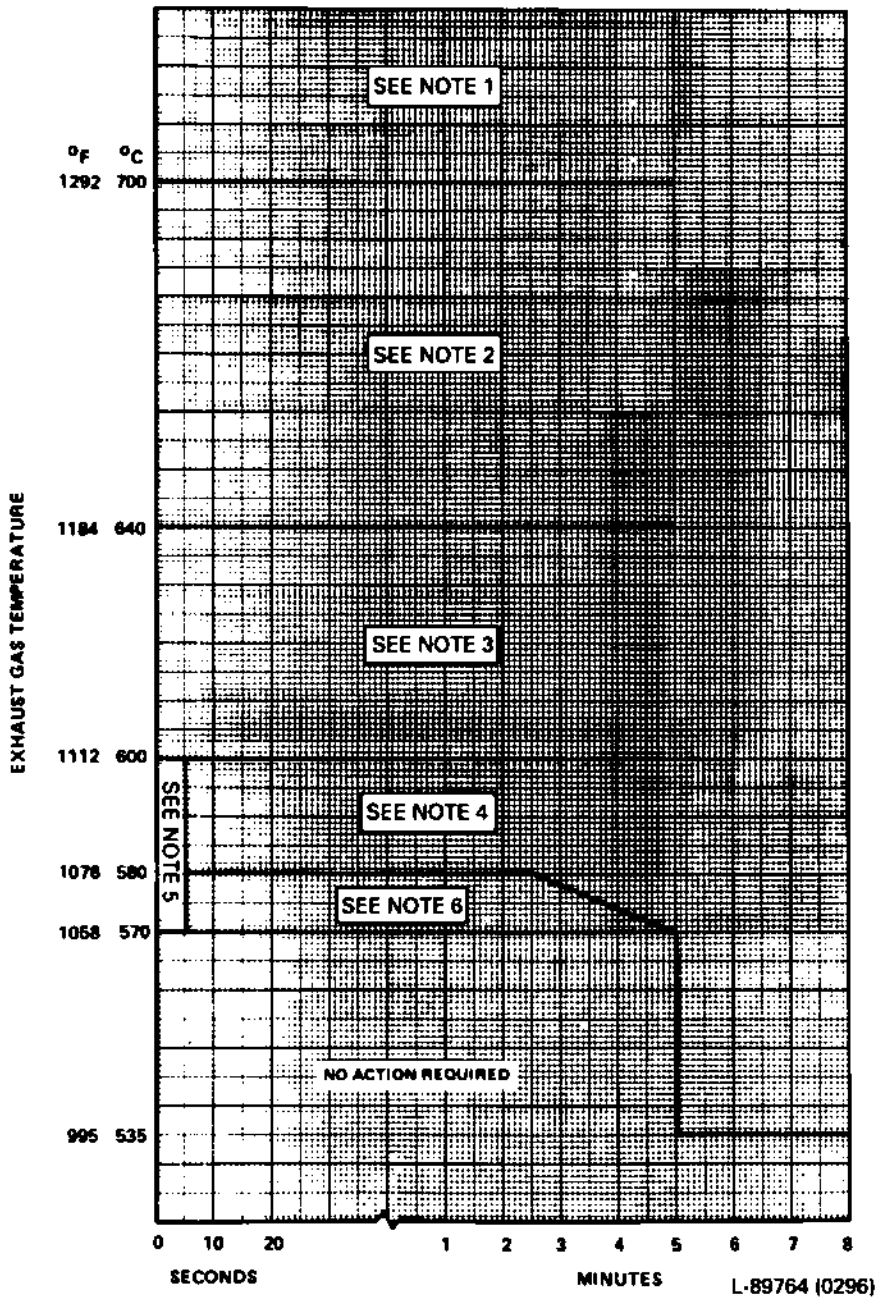
C. 1229° - 1301°F (665° - 705°C): Determine metal temperature of 1st stage turbine blades by optical metallurgical examination; blades which have not exceeded 2000°F (1093°C) metal temperature may be reused if they meet all other inspection criteria. Scrap blades which have exceeded 2000°F (1093°C) metal temperature; all other parts may be reused if inspection criteria are met (including turbine disk growth and hardness inspection).

D. 1301° - 1391°F (705° - 755°C): Same as C. above, plus examine 2nd stage turbine vanes directly behind several combustion chamber positions for metal temperature. Scrap vanes exposed to temperature in excess of 2000°F (1093°C).

E. 1391° - 1544°F (755° - 840°C): In addition to D. above, examine 2nd stage turbine blades and 3rd stage turbine vanes directly in line with several combustion chamber positions. Scrap parts exposed to temperature in excess of 2000°F (1093°C).

F. In excess of 1544°F (840°C): Same as A. above, but check all turbine blades and vanes for metal temperature. Scrap all parts exposed to temperature in excess of 2000°F (1093°C).

Key to Figure 502 (Sheet 7)



Overtemperature Limits And
Inspection Procedures For
JT8D-1, and -7 (Except Starting)
Figure 503 (Sheet 1)
(Task 72-00-00-760-008)

NOTE 1: Do a hot section inspection and disassemble the turbines for overhaul. Discard all 1st and 2nd stage turbine blades, and all 2nd and 3rd stage turbine vanes if metallographic inspection shows that the blade or vane metal temperature went higher than 2000°F (1093°C). All turbine parts must get the usual inspection procedures, including 1st stage turbine blade stretch and inspection of turbine disks for growth and hardness.

NOTE 2: Do a hot section inspection and disassemble the turbines for overhaul. All turbine parts must get the usual inspection procedures, including rear compressor drive turbine blade stretch and inspection of turbine disks for growth and hardness. Discard all 1st stage turbine blades if metallographic inspection shows that the blade metal temperature went higher than 2000°F (1093°C).

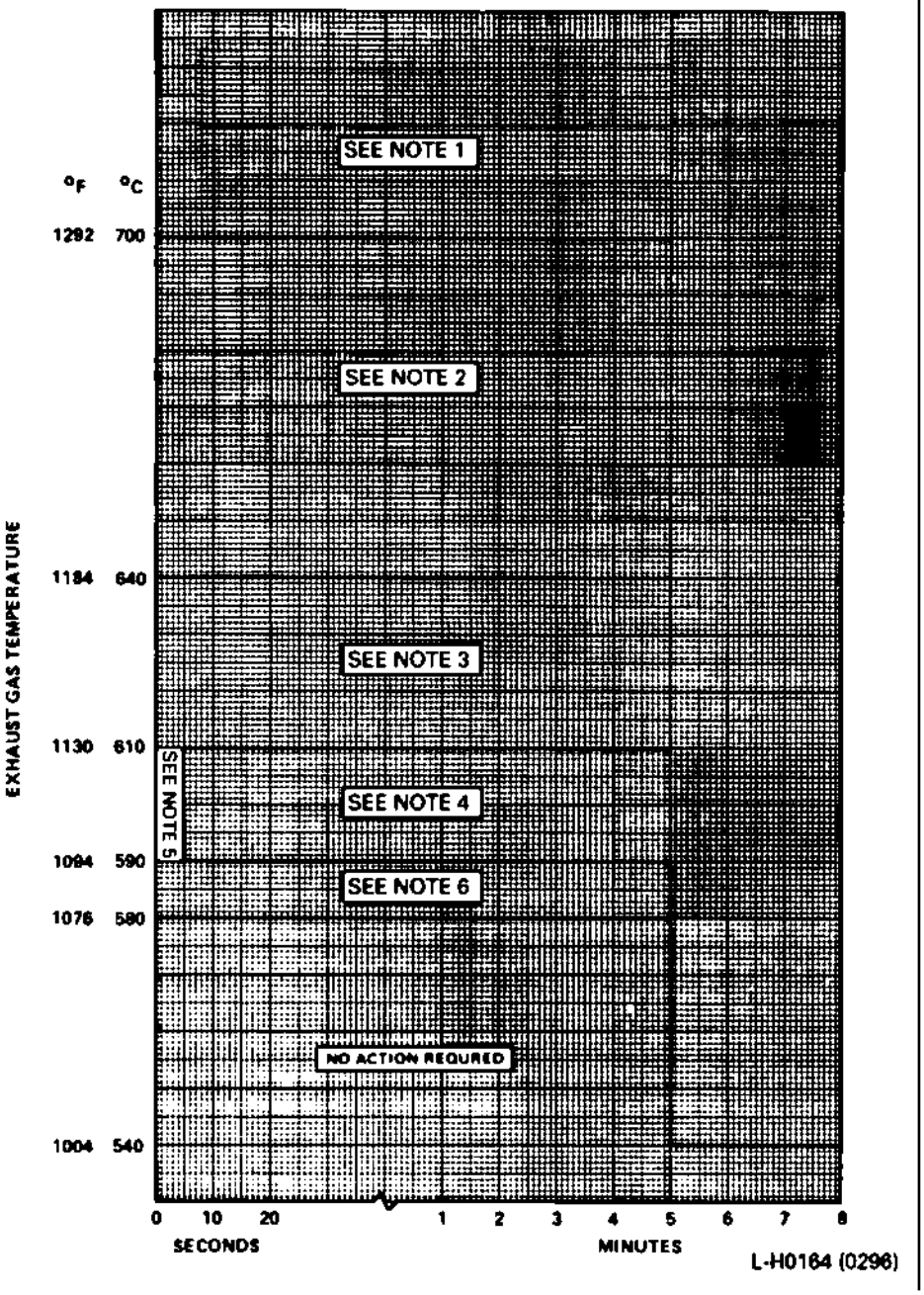
NOTE 3: Do a hot section inspection and do the usualinspection of the rear compressor drive turbine parts, including blade stretch and disk growth and hardness inspection.

NOTE 4: Do a hot section inspection or (as an alternate procedure) a fiberoptic inspection (flexible borescope). Refer to Section 72-00-00, Inspection/Check-01.

NOTE 5: For exhaust gas temperatures between 1058° - 1112°F (570° - 600°C), with a duration of five seconds or less, determine and correct cause of overtemperature. Visually check exhaust duct, and rear of low turbine for burning, distortion, metal particles or evidence of upstream blade and/or vane damage. Inspect engine inlet for evidence of blade or vane damage.

NOTE 6: For exhaust gas temperatures between 1058° - 1076°F (570° - 580°C), with a duration longer than five seconds, determine and correct cause of overtemperature after first occurrence. Enter into engine log. After second occurrence, perform hot section inspection within the next 40 hours of engine operation or by tenth occurrence, whichever occurs first. Determine and correct cause of overtemperature. Visually check exhaust duct, and rear of low turbine for burning, distortion, metal particles or evidence of upstream blade and/or vane damage. Inspect engine inlet for evidence of blade or vane damage.

Key to Figure 503 (Sheet 1)



Overtemperature Limits And
Inspection Procedures For JT8D-1A
and -7A (Except Starting)
Figure 503 (Sheet 2)
(Task 72-00-00-760-008)

NOTE 1: Do a hot section inspection and disassemble the turbines for overhaul. Discard all 1st and 2nd stage turbine blades, and all 2nd and 3rd stage turbine vanes if metallographic inspection shows that the blade or vane metal temperature went higher than 2000°F (1093°C). All turbine parts must get the usual inspection procedures, including 1st stage turbine blade stretch and inspection of turbine disks for growth and hardness.

NOTE 2: Do a hot section inspection and disassemble the turbines for overhaul. All turbine parts must get the usual inspection procedures, including rear compressor drive turbine blade stretch and inspection of turbine disks for growth and hardness. Discard all 1st stage turbine blades if metallographic inspection shows that the blade metal temperature went higher than 2000°F (1093°C).

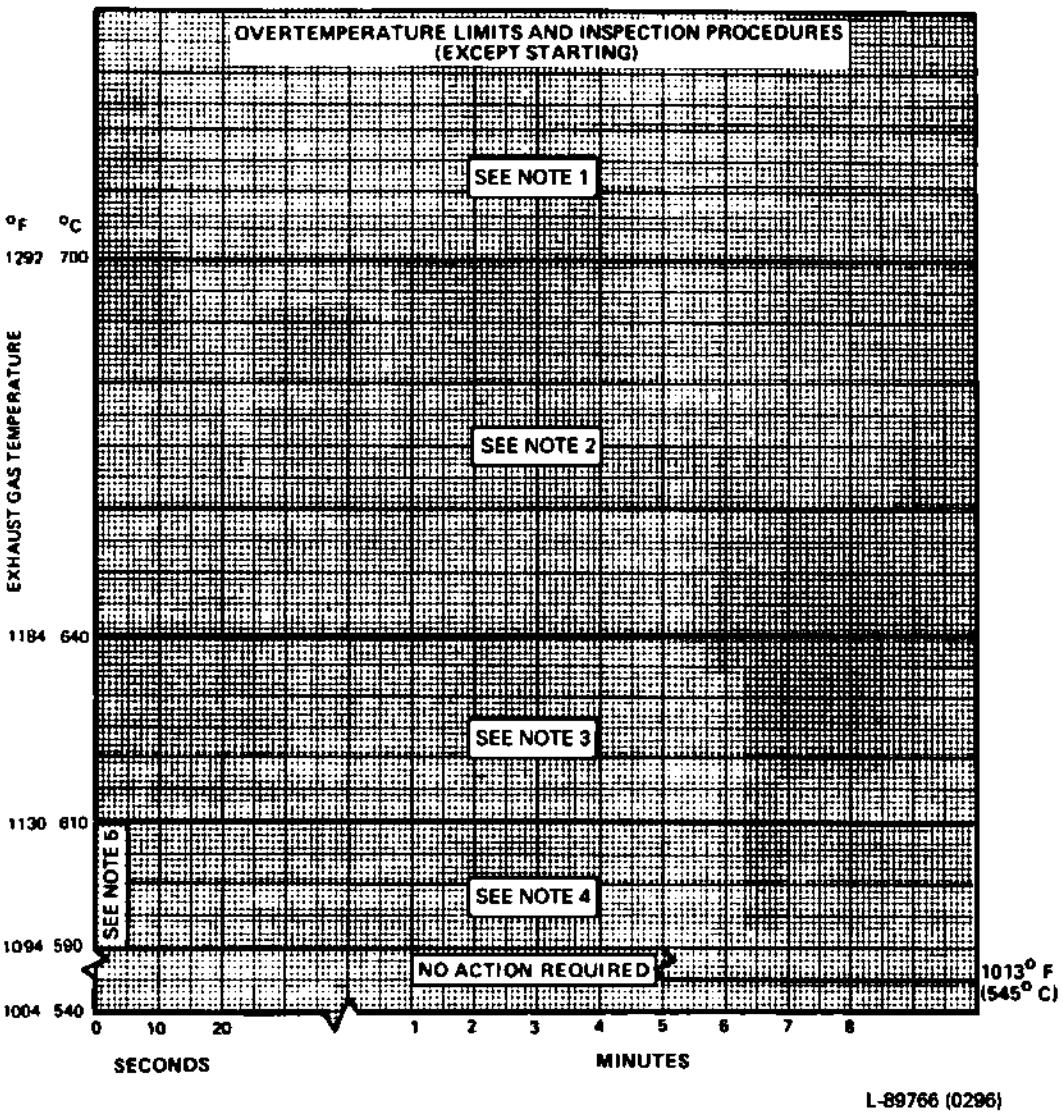
NOTE 3: Do a hot section inspection and do the usual inspection of the rear compressor drive turbine parts, including blade stretch and disk growth and hardness inspection.

NOTE 4: Do a hot section inspection or (as an alternate procedure) a fiberoptic inspection (flexible borescope). Refer to Section 72-00-00, Inspection/Check-01.

NOTE 5: For exhaust gas temperatures between 1094° - 1130°F (590° - 610°C), with a duration of five seconds or less, determine and correct cause of overtemperature. Visually check exhaust duct, and rear of low turbine for burning, distortion, metal particles or evidence of upstream blade and/or vane damage. Inspect engine inlet for evidence of blade or vane damage.

NOTE 6: For exhaust gas temperatures between 1076° - 1094°F (580° - 590°C), with a duration up to five minutes, determine and correct cause of overtemperature.

Key to Figure 503 (Sheet 2)



Overtemperature Limits And
Inspection Procedures For JT8D-1B
And -7B (Except Starting)
Figure 503 (Sheet 3)
(Task 72-00-00-760-008)

NOTE 1: Discard all 1st and 2nd stage turbine blades, and all 2nd and 3rd stage turbine vanes if metallographic inspection shows that the blade or vane metal temperature went higher than 2000°F (1093°C). All turbine parts must get the usual inspection procedures, including 1st stage turbine blade stretch and inspection of turbine disks for growth and hardness.

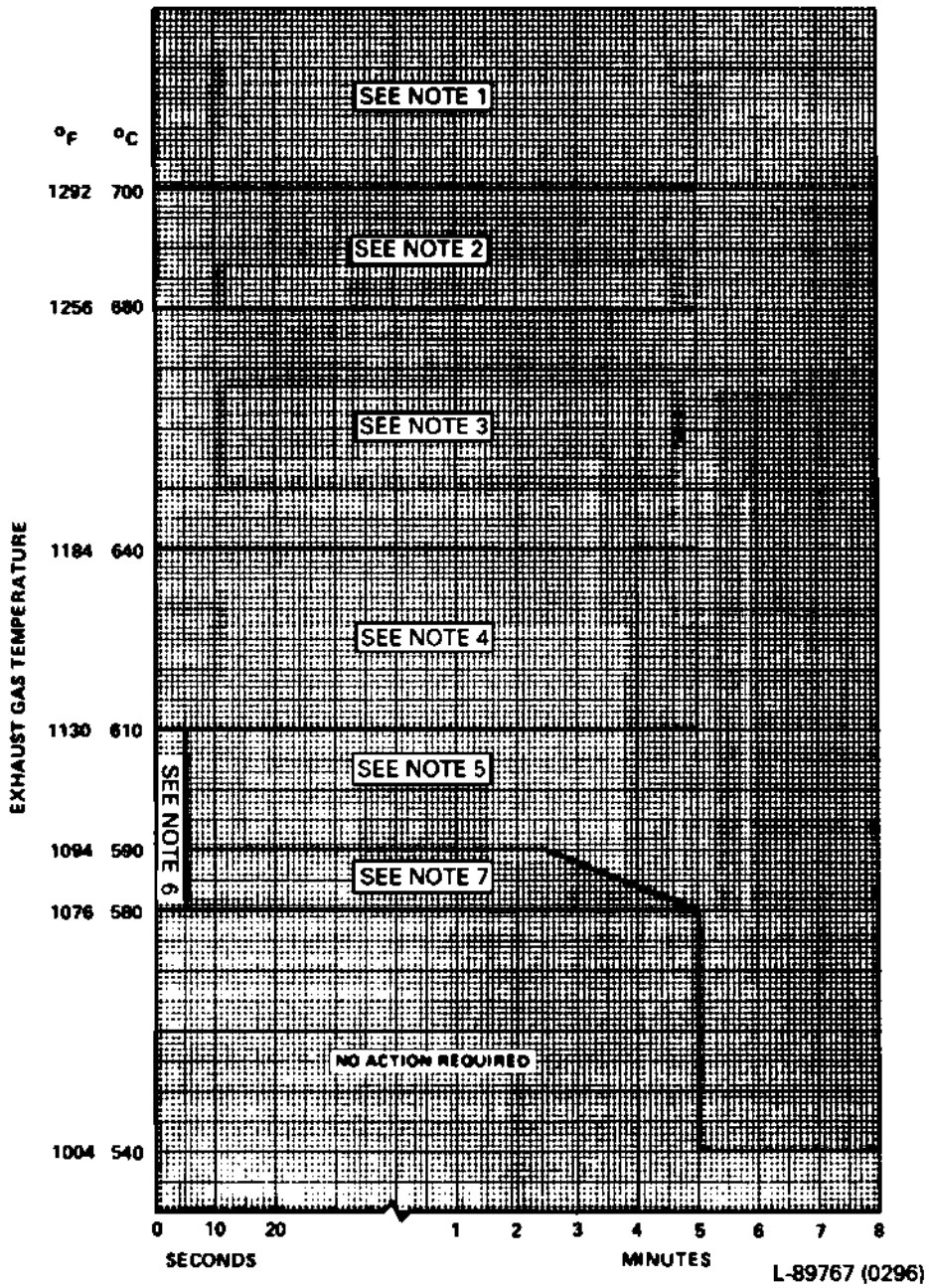
NOTE 2: If metallographic inspection shows that the 1st stage turbine blade metal temperature went higher than 2000°F (1093°C), discard all 1st stage turbine blades. Do an overhaul of the front compressor drive turbine and make sure all parts are satisfactory by inspection. Discard all 2nd stage blades of material other than PWA 655. Do the usual inspection of all other turbine parts including 1st stage turbine blade stretch and inspection of turbine disks for growth and hardness.

NOTE 3: Do an overhaul of the hot section and do the usual inspection of the rear compressor drive turbine parts, including blade stretch and disk growth and hardness inspection. Inspection of front compressor drive turbine parts of material other than PWA 655 will also be necessary.

NOTE 4: Do a hot section inspection or (as an alternate procedure) a fiberoptic inspection (flexible borescope). Refer to Section 72-00-00, Inspection/Check-01.

NOTE 5: For exhaust gas temperatures between 1094° - 1130°F (590° - 610°C), with a duration of five seconds or less, determine and correct cause of overtemperature. Visually check exhaust duct, and rear of low turbine for burning, distortion, metal particles or evidence of upstream blade and/or vane damage. Inspect engine inlet for evidence of blade or vane damage.

Key to Figure 503 (Sheet 3)



Overtemperature Limits And
Inspection Procedures For
JT8D-9 (Except Starting)
Figure 503 (Sheet 4)
(Task 72-00-00-760-008)

NOTE 1: Do a hot section inspection and disassemble the turbines for overhaul. Discard all 1st and 2nd stage turbine blades, and all 2nd and 3rd stage turbine vanes if metallographic inspection shows that the blade or vane metal temperature went higher than 2000°F (1093°C). All turbine parts must get the usual inspection procedures, including 1st stage turbine blade stretch and inspection of turbine disks for growth and hardness.

NOTE 2: Do a hot section inspection and disassemble the turbines for overhaul. All turbine parts must get the usual inspection procedures, including rear compressor drive turbine blade stretch and inspection of turbine disks for growth and hardness. Discard all 1st stage turbine blades if metallographic inspection shows that the blade metal temperature went higher than 2000°F (1093°C).

NOTE 3: Do a hot section inspection and do the usual inspection of the rear compressor drive turbine parts, including blade stretch and disk growth and hardness inspection. Discard all 1st stage turbine blades if metallographic inspection shows that the blade metal temperature went higher than 2000°F (1093°C).

NOTE 4: Do a hot section inspection and do the usual inspection of the rear compressor drive turbine parts, including blade stretch and disk growth and hardness inspection.

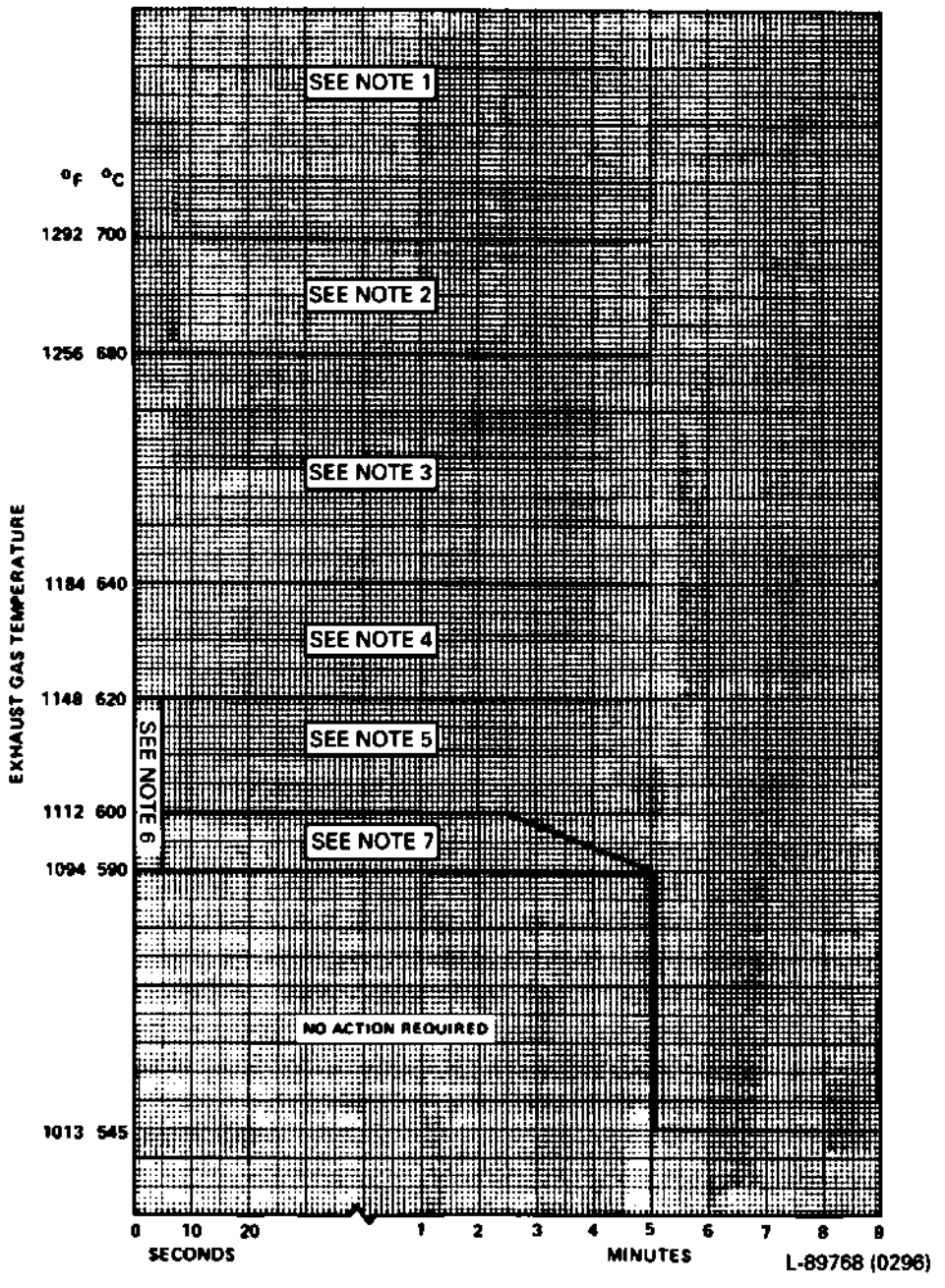
NOTE 5: Do a hot section inspection or (as an alternate procedure) a fiberoptic inspection (flexible borescope). Refer to Section 72-00-00, Inspection/Check-01.

NOTE 6: For exhaust gas temperatures between 1076° - 1130°F (580° - 610°C), with a duration of five seconds or less, determine and correct cause of overtemperature. Visually check exhaust duct, and rear of low turbine for burning, distortion, metal particles or evidence of upstream blade and/or vane damage. Inspect engine inlet for evidence of blade or vane damage.

Key To Figure 503 (Sheet 4)

NOTE 7: For exhaust gas temperatures between 1076° - 1094°F (580° - 590°C), with a duration longer than five seconds, determine and correct cause of overtemperature after first occurrence. Enter into engine log. After second occurrence, perform hot section inspection within the next 40 hours of engine operation or by tenth occurrence, whichever occurs first. Determine and correct cause of overtemperature. Visually check exhaust duct, and rear of low turbine for burning, distortion, metal particles or evidence of upstream blade and/or vane damage. Inspect engine inlet for evidence of blade or vane damage.

Key To Figure 503 (Sheet 4) Continued



Overtemperature Limits And
Inspection Procedures For
JT8D-9A (Except Starting)
Figure 503 (Sheet 5)
(Task 72-00-00-760-008)

NOTE 1: Do a hot section inspection and disassemble the turbines for overhaul. Discard all 1st and 2nd stage turbine blades, and all 2nd and 3rd stage turbine vanes if metallographic inspection shows that the blade or vane metal temperature went higher than 2000°F (1093°C). All turbine parts must get the usual inspection procedures, including 1st stage turbine blade stretch and inspection of turbine disks for growth and hardness.

NOTE 2: Do a hot section inspection and disassemble the turbines for overhaul. All turbine parts must get the usual inspection procedures, including rear compressor drive turbine blade stretch and inspection of turbine disks for growth and hardness. Discard all 1st stage turbine blades if metallographic inspection shows that the blade metal temperature went higher than 2000°F (1093°C).

NOTE 3: Do a hot section inspection and do the usual inspection of the rear compressor drive turbine parts, including blade stretch and disk growth and hardness inspection. Discard all 1st stage turbine blades if metallographic inspection shows that the blade metal temperature went higher than 2000°F (1093°C).

NOTE 4: Do a hot section inspection and do the usual inspection of the rear compressor drive turbine parts, including blade stretch and disk growth and hardness inspection.

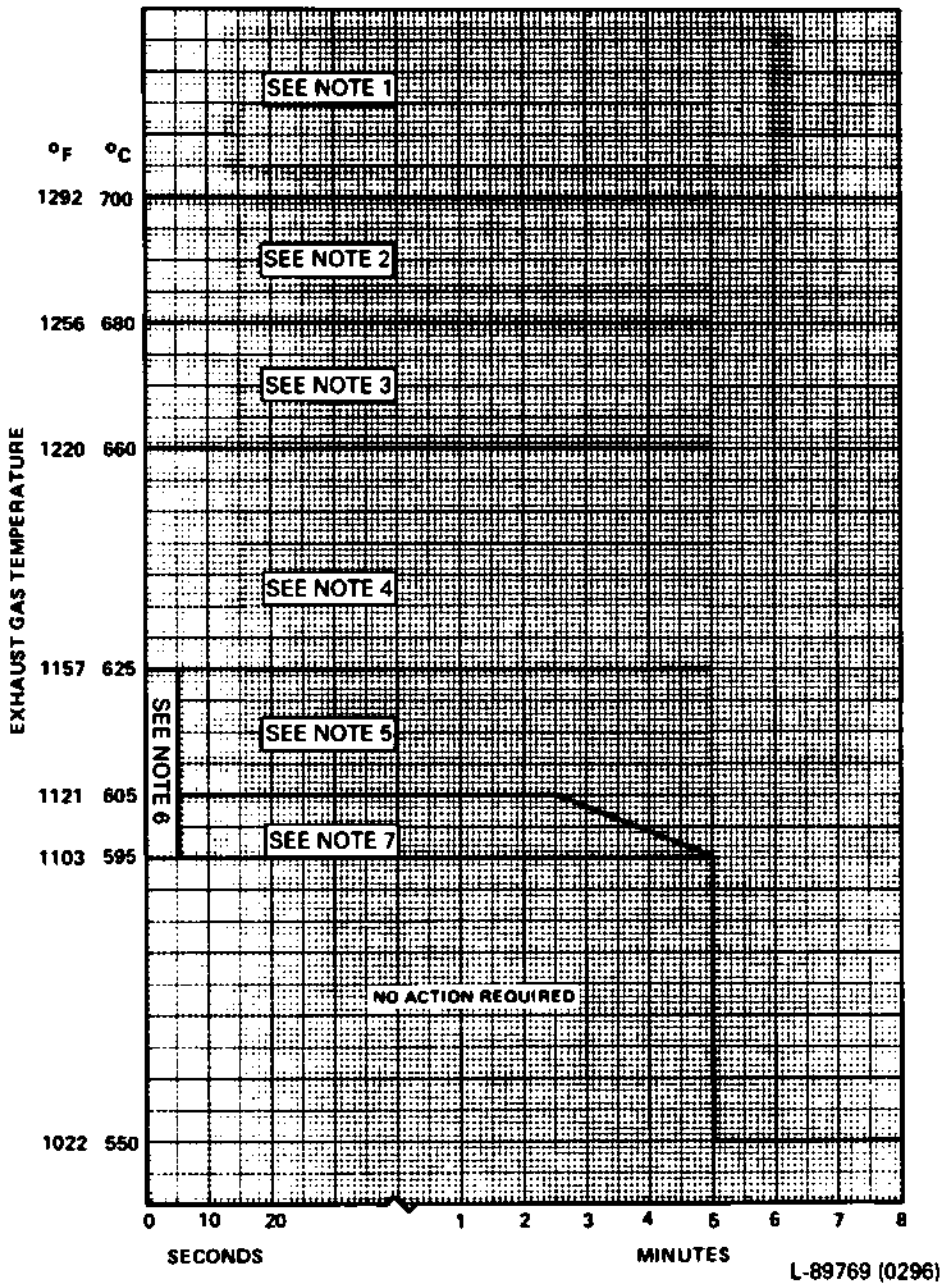
NOTE 5: Do a hot section inspection or, as an alternate procedure, a fiberoptic inspection (flexible borescope). Refer to Section 72-00-00, Inspection/Check-01.

NOTE 6: For exhaust gas temperatures between 1094° - 1148°F (590° - 620°C), with a duration of five seconds or less, determine and correct cause of overtemperature. Visually check exhaust duct, and rear of low turbine for burning, distortion, metal particles or signs of upstream blade and/or vane damage. Inspect engine inlet for signs of blade or vane damage.

Key To Figure 503 (Sheet 5)

NOTE 7: For exhaust gas temperatures between 1094° - 1112°F (590° - 600°C), with a duration longer than five seconds (upper time limit to be determined by reference to figure), determine and correct cause of overtemperature after first occurrence. Enter into engine log. After second occurrence, do a hot section inspection or, as an alternate procedure, a fiberoptic inspection (flexible borescope) in the next 40 hours of engine operation or by tenth occurrence, whichever occurs first. Determine and correct cause of overtemperature. Visually check exhaust duct, and rear of low turbine for burning, distortion, metal particles or signs of upstream blade and/or vane damage. Inspect engine inlet for signs of blade or vane damage.

Key To Figure 503 (Sheet 5) Continued



Overtemperature Limits And
Inspection Procedures For
JT8D-11 (Except Ground Starting)
Figure 503 (Sheet 6)
(Task 72-00-00-760-008)

NOTE 1: Do a hot section inspection and disassemble the turbines for overhaul. Discard all 1st and 2nd stage turbine blades, and all 2nd and 3rd stage turbine vanes if metallographic inspection shows that the blade or vane metal temperature went higher than 2000°F (1093°C). All turbine parts must get the usual inspection procedures, including 1st stage turbine blade stretch and inspection of turbine disks for growth and hardness.

NOTE 2: Do a hot section inspection and disassemble the turbines for overhaul. All turbine parts must get the usual inspection procedures, including rear compressor drive turbine blade stretch and inspection of turbine disks for growth and hardness. Discard all 1st stage turbine blades if metallographic inspection shows that the blade metal temperature went higher than 2000°F (1093°C).

NOTE 3: Do a hot section inspection and do the usual inspection of the rear compressor drive turbine parts, including blade stretch and disk growth and hardness inspection. Discard all 1st stage turbine blades if metallographic inspection shows that the blade metal temperature went higher than 2000°F (1093°C).

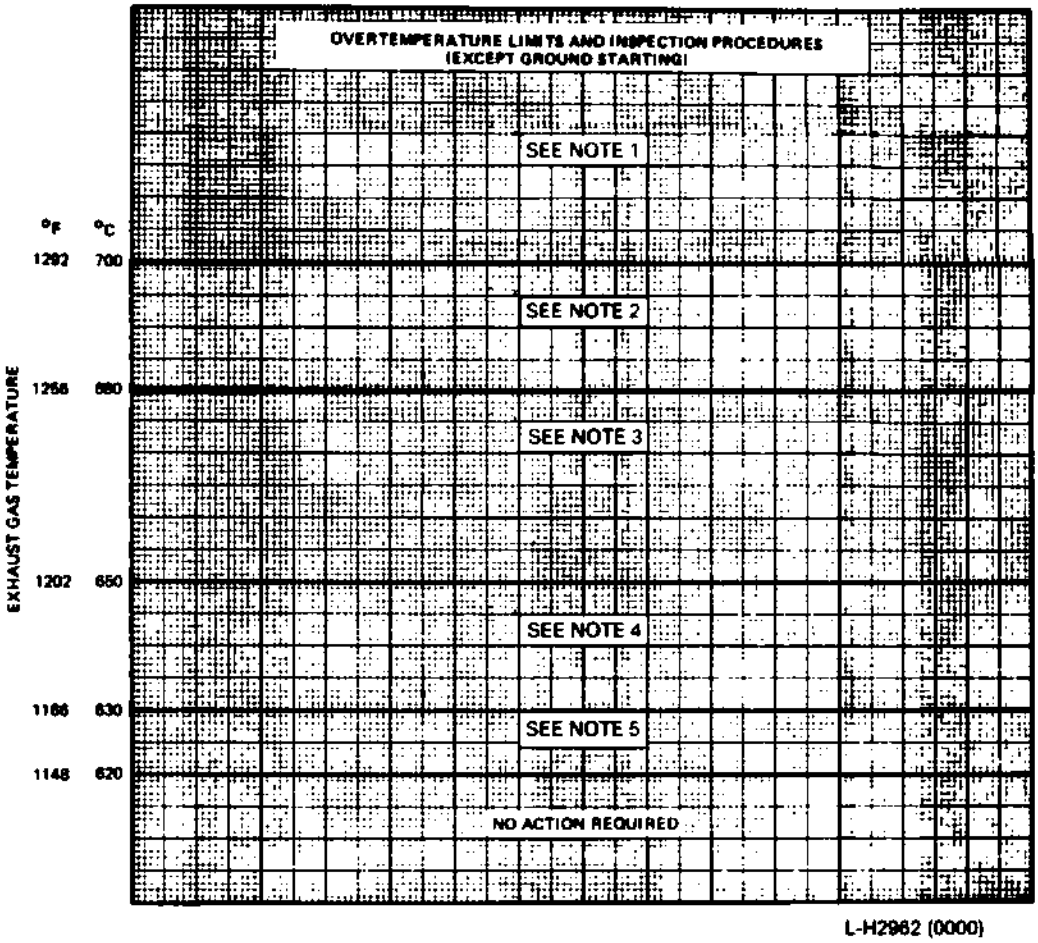
NOTE 4: Do a hot section inspection and do the usual inspection of the rear compressor drive turbine parts, including blade stretch and disk growth and hardness inspection.

NOTE 5: Do a hot section inspection or (as an alternate procedure) a fiberoptic inspection (flexible borescope). Refer to Section 72-00-00, Inspection/Check-01.

NOTE 6: For exhaust gas temperature between 1103° - 1157°F (595° - 625°C), with a duration of five seconds or less, determine and correct cause of overtemperature. Visually check exhaust duct, and rear of low turbine for burning, distortion, metal particles or evidence of upstream blade and/or vane damage. Inspect engine inlet for evidence of blade or vane damage.

Key to Figure 503 (Sheet 6)

NOTE 7: For exhaust gas temperatures between 1103° - 1121°F (595° - 605°C), with a duration longer than five seconds, determine and correct cause of overtemperature after first occurrence. Enter into engine log. After second occurrence, perform hot section inspection within the next 40 hours of engine operation or by tenth occurrence, whichever occurs first. Determine and correct cause of overtemperature. Visually check exhaust duct, and rear of low turbine for burning, distortion, metal particles or evidence of upstream blade and/or vane damage. Inspect engine inlet for evidence of blade or vane damage.



Overtemperature Limits And
Inspection Procedures For JT8D-15
And -15A (Except Ground Starting)
Figure 503 (Sheet 7)
(Task 72-00-00-760-008)

NOTE 1: Discard all 1st and 2nd stage turbine blades and all 2nd and 3rd stage turbine vanes if metallographic inspection shows that the blade or vane metal temperature went higher than 2000°F (1093°C). All turbine parts must get the usual inspection procedures, including 1st stage turbine blade stretch and inspection of turbine disks for growth and hardness.

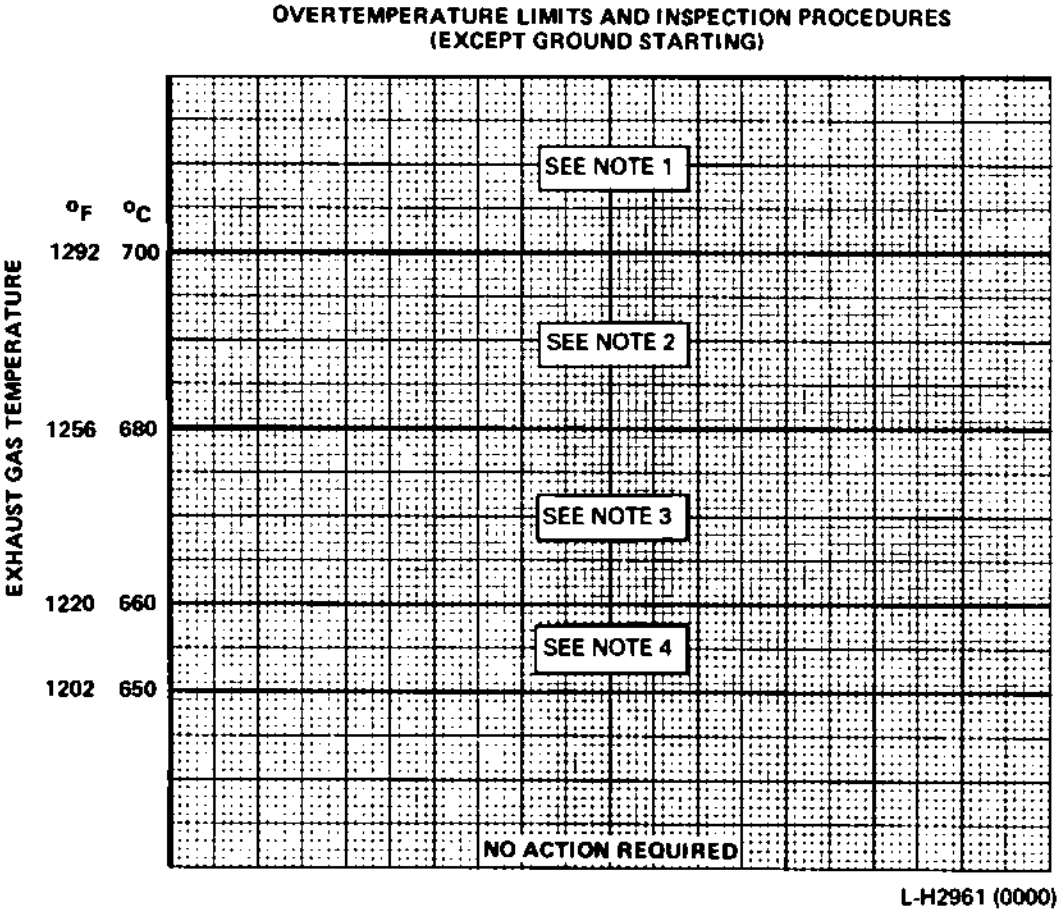
NOTE 2: If metallographic inspection shows that the 1st stage turbine blade metal temperature went higher than 2000°F (1093°C), discard all 1st stage turbine blades. Do an overhaul of the front compressor drive turbine and make sure all parts are satisfactory by inspection. Do stretch checks on 1st stage turbine blades and growth and hardness checks on all turbine disks.

NOTE 3: Do an overhaul of the hot section and do the usual inspection of the rear compressor drive turbine parts, including blade stretch and disk growth and hardness inspection.

NOTE 4: For exhaust gas temperatures between 1166° - 1202°F (630° - 650°C), with a duration of five seconds or less, determine and correct cause of overtemperature. Visually check exhaust duct, and rear of low turbine for burning, distortion, metal particles or evidence of upstream blade and/or vane damage. Inspect engine inlet for evidence of blade or vane damage. Repeated overtemperatures or overtemperatures longer than five seconds require Hot Section inspection or an alternative flexible fiberoptic borescope inspection (See Section 72-00-00, Inspection/ Check-01 (Task 72-00-00-210-003)). Regardless of duration, determine and correctcause of overtemperature.

NOTE 5: Transitory periods during the first two minutes of a normal take-off require no action. Beyond two minutes requires a complete Hot Section inspection.

Key to Figure 503 (Sheet 7)



Overtemperature Limits And
Inspection Procedures For JT8D-17
And -17A (Except Ground Starting)
Figure 503 (Sheet 8)
(Task 72-00-00-760-008)

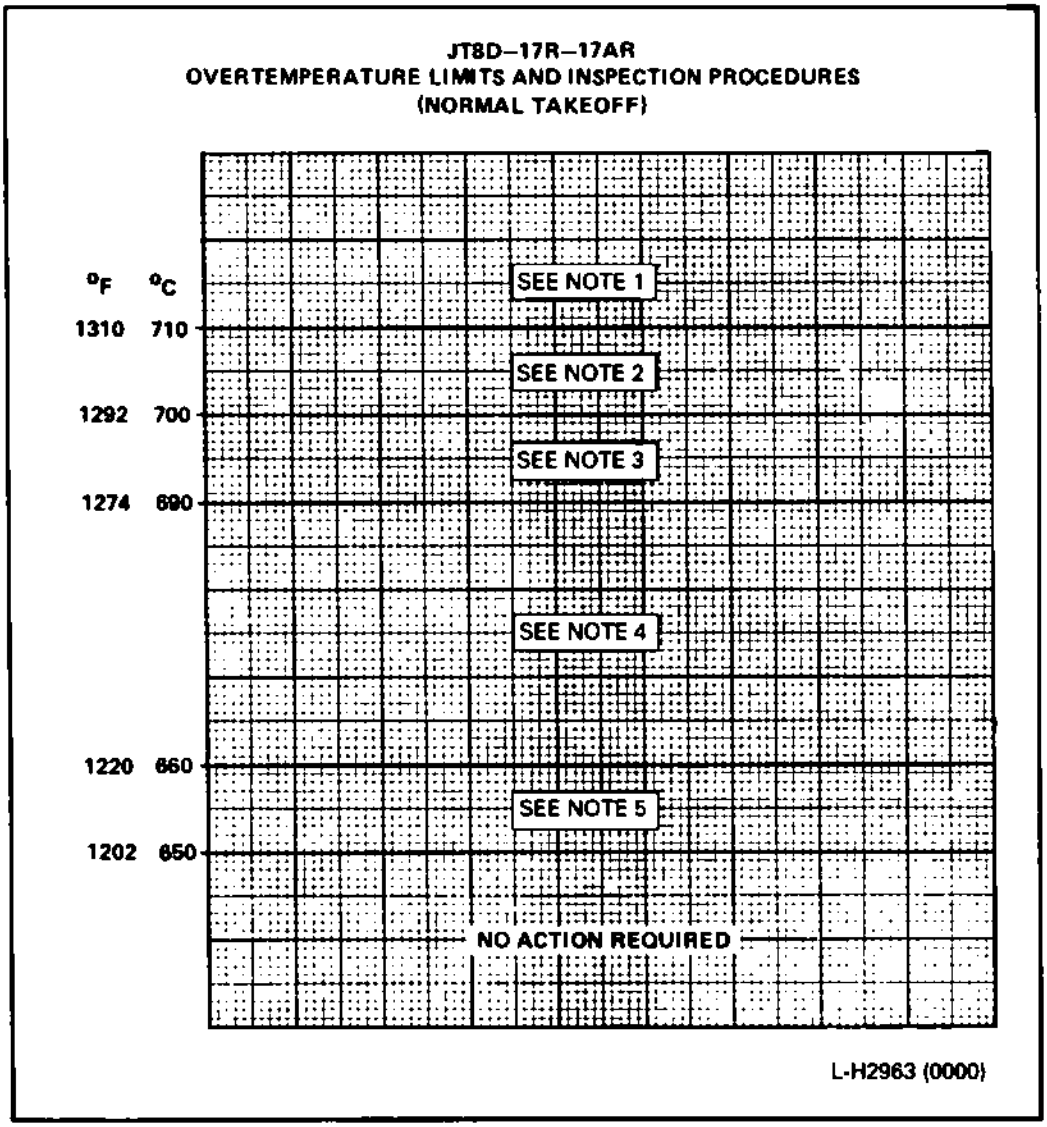
NOTE 1: Discard all 1st and 2nd stage turbine blades and all 2nd and 3rd stage turbine vanes if metallographic inspection shows that the blade or vane metal temperature went higher than 2000°F (1093°C). All turbine parts must get the usual inspection procedures, including 1st stage turbine blade stretch and inspection of turbine disks for growth and hardness.

NOTE 2: Overhaul of the hot section, rear compressor drive turbine, and front compressor drive turbine will be necessary. Give all turbine parts the usual inspection procedures, including 1st stage turbine blade stretch and inspection of turbine disks for growth and hardness.

NOTE 3: For exhaust gas temperatures between 1220° - 1256°F (660° - 680°C), with a duration of five seconds or less, determine and correct cause of overtemperature. Visually check exhaust duct, and rear of low turbine for burning, distortion, metal particles or evidence of upstream blade and/or vane damage. Inspect engine inlet for evidence of blade or vane damage. Repeated overtemperatures or overtemperatures longer than five seconds require Hot Section inspection or an alternative flexible fiberoptic borescope inspection (See Section 72-00-00, Inspection/Check-01 (Task 72-00-00-210-003)). Regardless of duration, determine and correct cause of overtemperature.

NOTE 4: Transitory periods during the first two minutes of a normal take-off require no action. Beyond two minutes requires a complete Hot Section inspection.

Key to Figure 503 (Sheet 8)



Normal Takeoff Overtemperature
Limits And Inspection
Procedures For JT8D-17R And
-17AR (Except Ground Starting)
Figure 503 (Sheet 9)
(Task 72-00-00-760-008)

NOTE 1: Discard all 1st and 2nd stage turbine blades and all 2nd and 3rd stage turbine vanes if metallographic inspection shows that the blade or vane metal temperature went higher than 2000°F (1093°C). All turbine parts must get the usual inspection procedures, including 1st stage turbine blade stretch and inspection of turbine disks for growth and hardness.

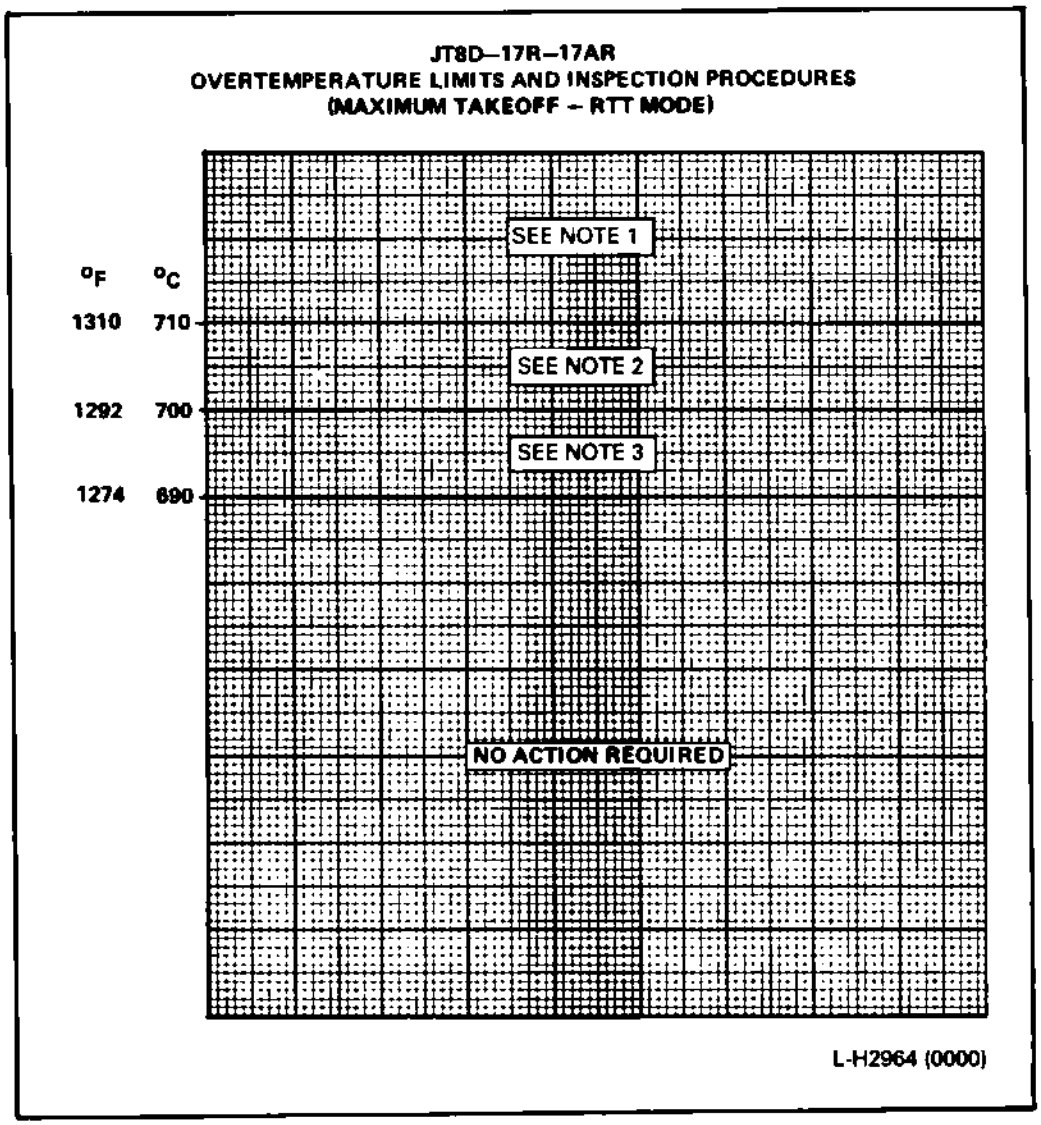
NOTE 2: Overhaul of the hot section, rear compressor drive turbine, and front compressor drive turbine will be necessary. Give all turbine parts the usual inspection procedures, including 1st stage turbine blade stretch and inspection of turbine disks for growth and hardness.

NOTE 3: For exhaust gas temperatures between 1274° - 1292°F (690° - 700°C), with a duration of five seconds or less, determine and correct cause of overtemperature. Visually check exhaust duct, and rear of low turbine for burning, distortion, metal particles or evidence of upstream blade and/or vane damage. Inspect engine inlet for evidence of blade or vane damage. Overtemperatures longer than five seconds require Hot Section Inspection same as for 700° - 710°C range. Regardless of duration, deactivate RTT system and determine and correct cause of overtemperature.

NOTE 4: Regardless of duration of overtemperature, deactivate RTT system. Determine and correct cause of overtemperature prior to reactivating RTT system.

NOTE 5: Transitory periods during the first two minutes of a normal takeoff require no action. Beyond two minutes deactivate RTT system. Determine and correct cause of overtemperature prior to reactivating RTT system.

Key to Figure 503 (Sheet 9)



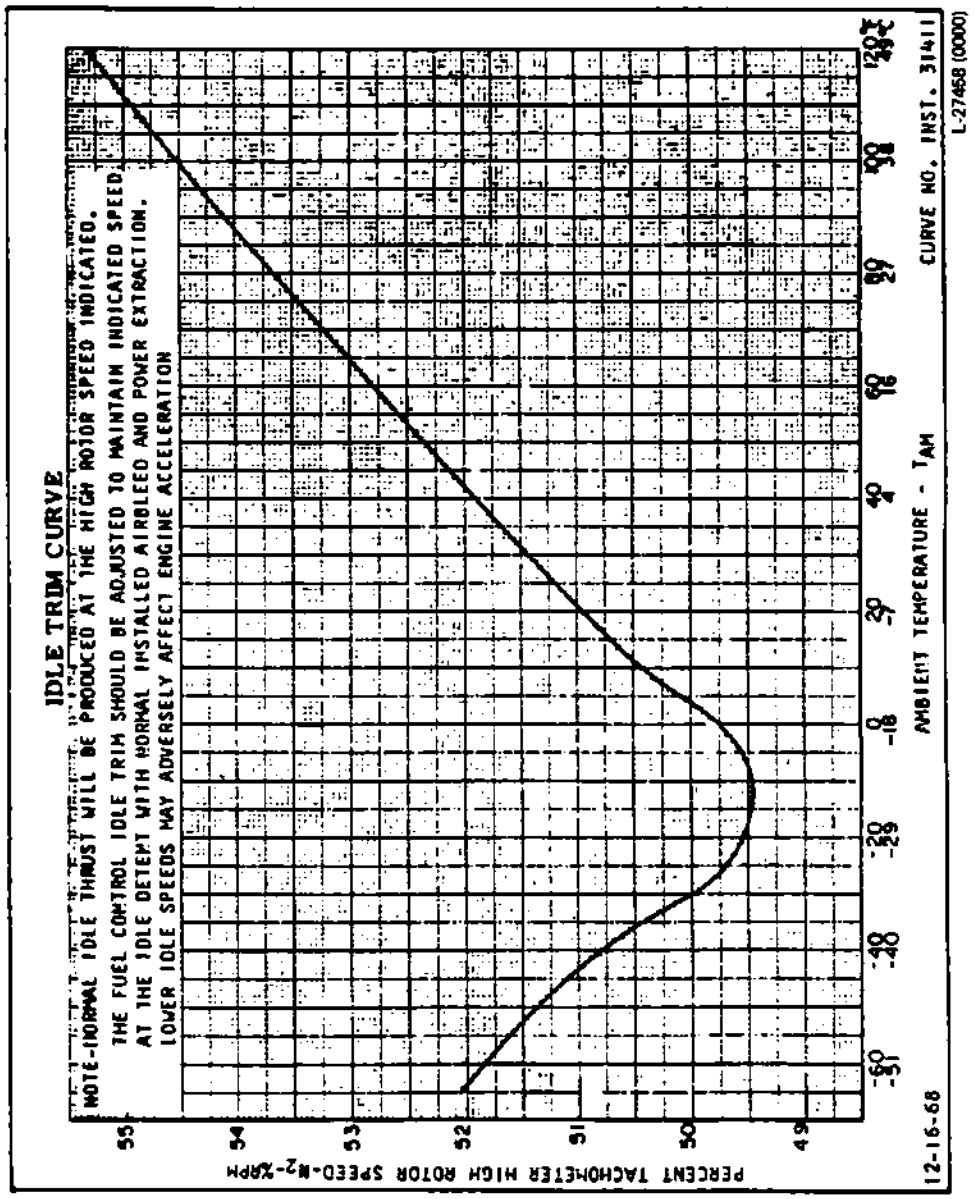
Maximum Takeoff Overtemperature
Limits And Inspection
Procedures JT8D-17R And -17AR
(Except Ground Starting)
Figure 503 (Sheet 10)
(Task 72-00-00-760-008)

NOTE 1: Discard all 1st and 2nd stage turbine blades and all 2nd and 3rd stage turbine vanes if metallographic inspection shows that the blade or vane metal temperature went higher than 2000°F (1093°C). All turbine parts must get the usual inspection procedures, including 1st stage turbine blade stretch and inspection of turbine disks for growth and hardness.

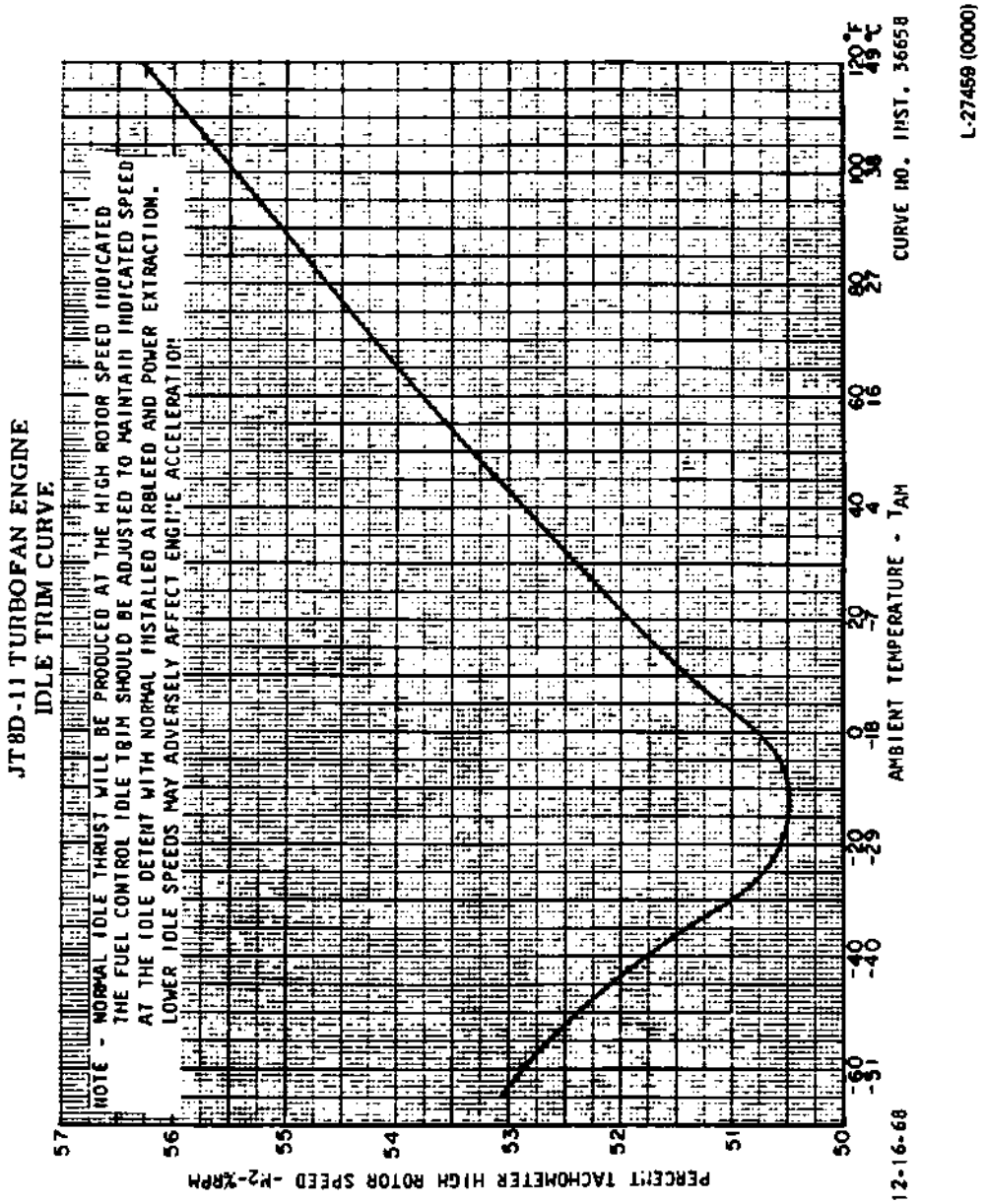
NOTE 2: Overhaul of the hot section, rear compressor drive turbine, and front compressor drive turbine will be necessary. Give all turbine parts the usual inspection procedures, including 1st stage turbine blade stretch and inspection of turbine disks for growth and hardness.

NOTE 3: For exhaust gas temperatures between 1274° - 1292°F (690° - 700°C), with a duration of five seconds or less, determine and correct cause of overtemperature. Visually check exhaust duct, and rear of low turbine for burning, distortion, metal particles or evidence of upstream blade and/or vane damage. Inspect engine inlet for evidence of blade or vane damage. Overtemperatures longer than five seconds require Hot Section Inspection same as for 700° - 710°C range. Regardless of duration, deactivate RTT system and determine and correct cause of overtemperature.

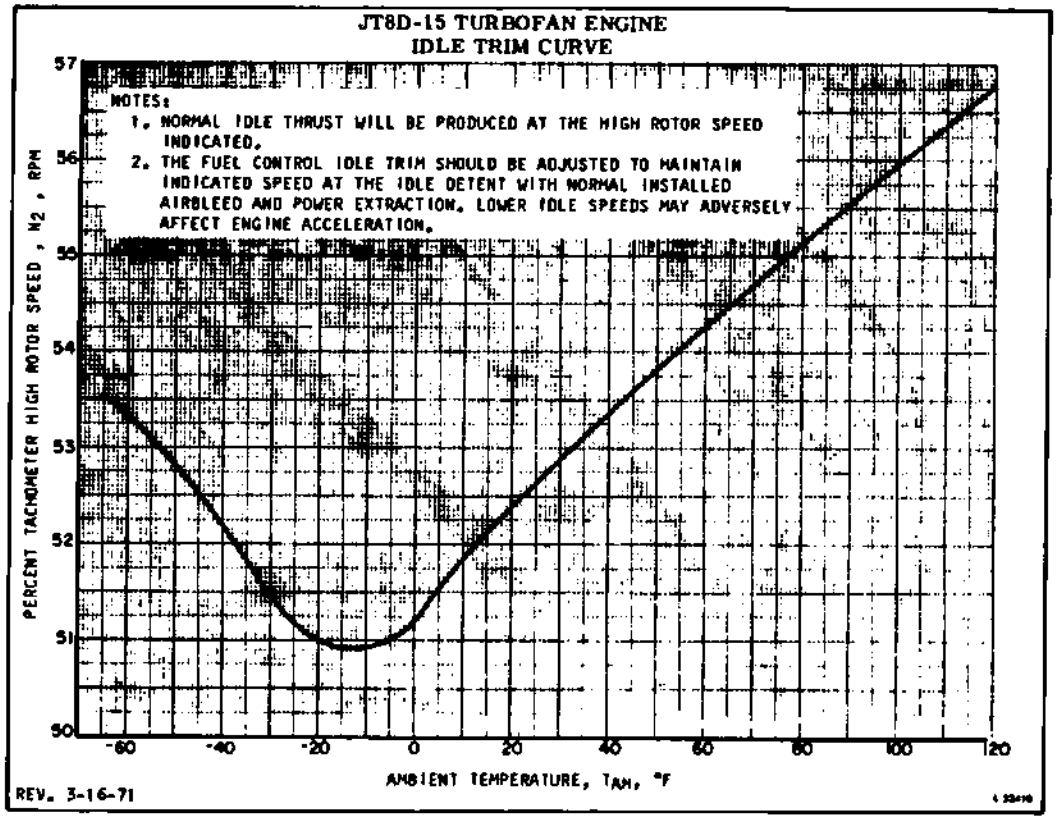
Key to Figure 503 (Sheet 10)



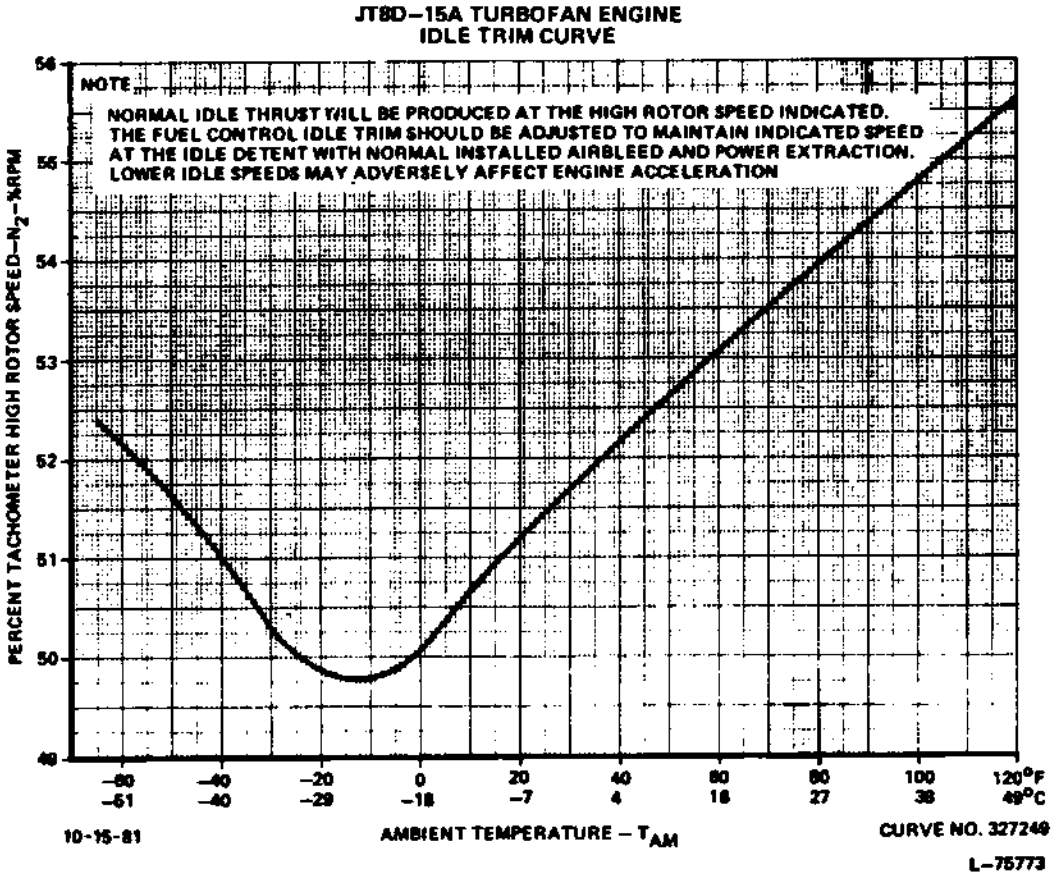
Idle Trim Curve
(JT8D-1,-1A,-1B,-7,-7A,-7B,-9,-9A)
Figure 504 (Sheet 1)
(Task 72-00-00-760-008)



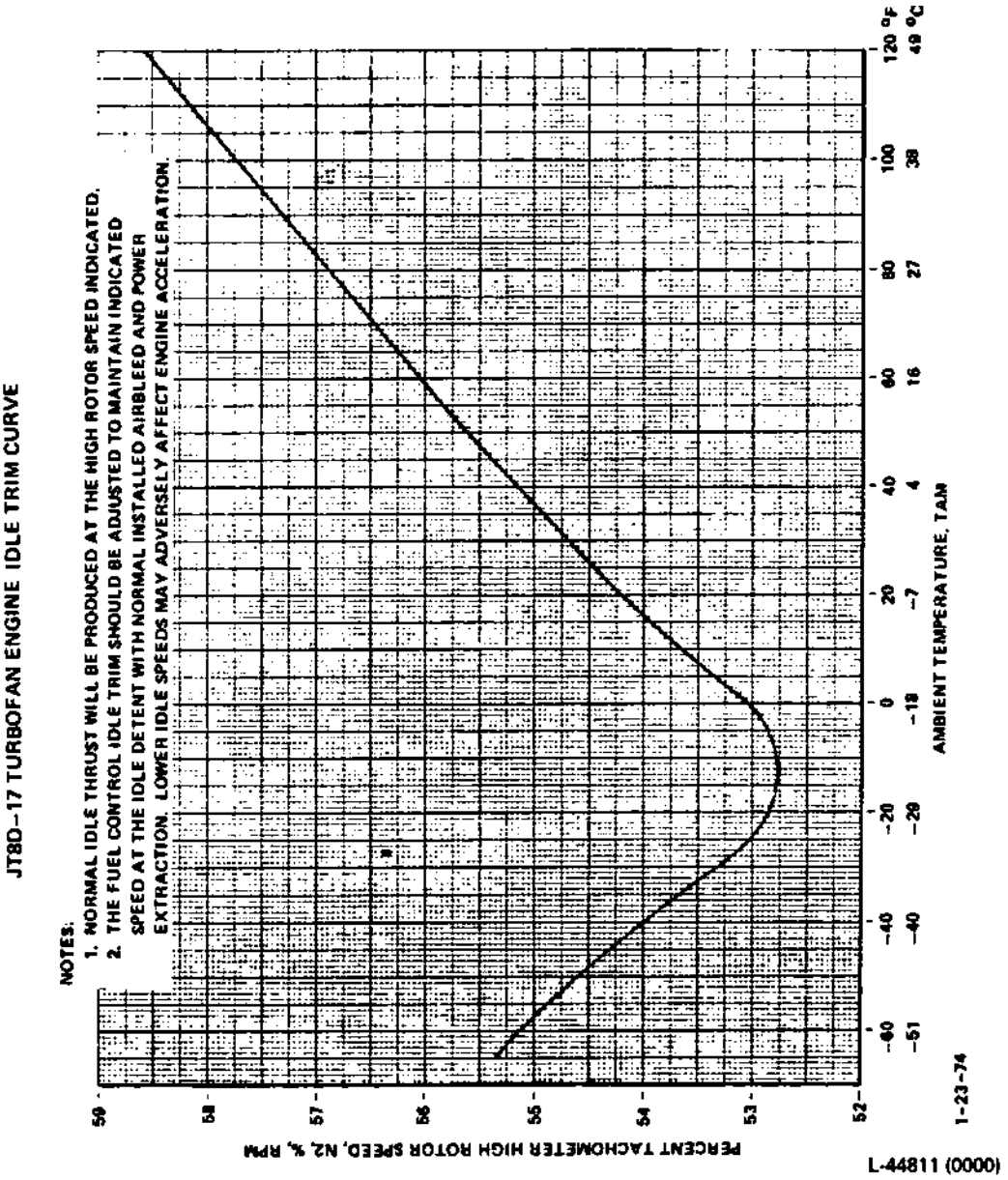
Idle Trim Curve (JT8D-11)
Figure 504 (Sheet 2)
(Task 72-00-00-760-008)



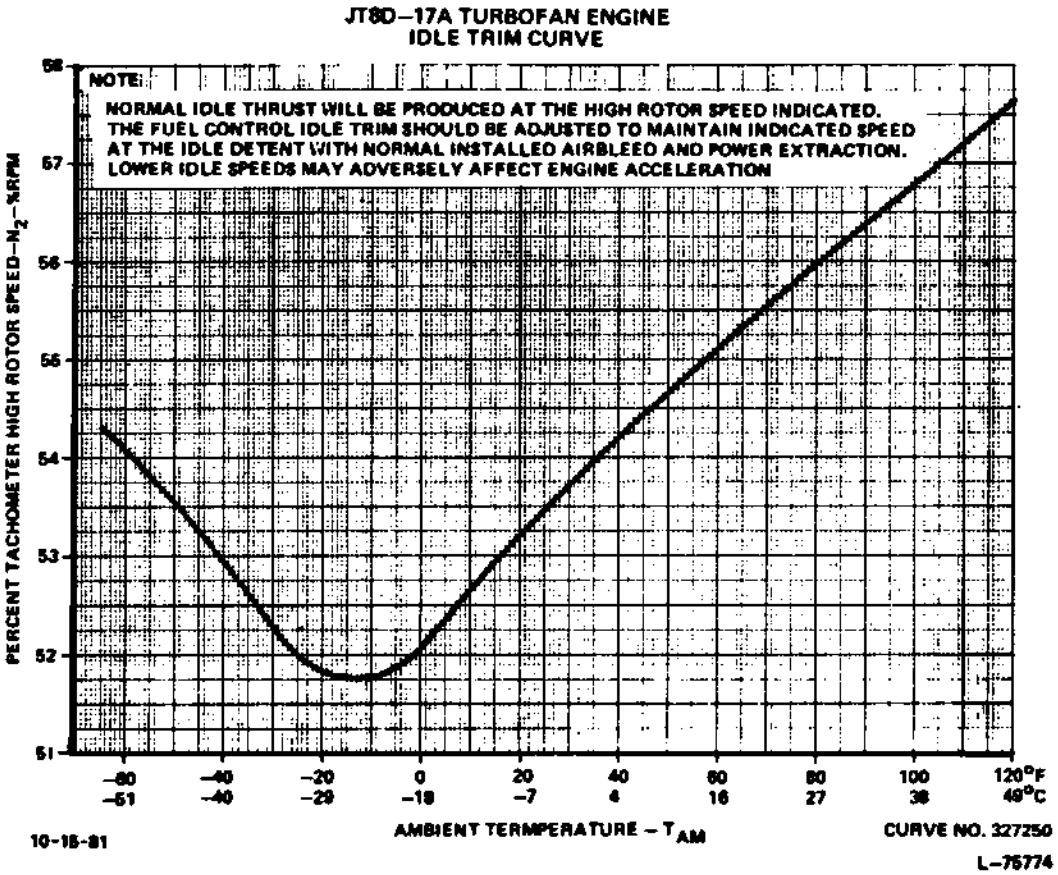
Idle Trim Curve (JT8D-15)
Figure 504 (Sheet 3)
(Task 72-00-00-760-008)



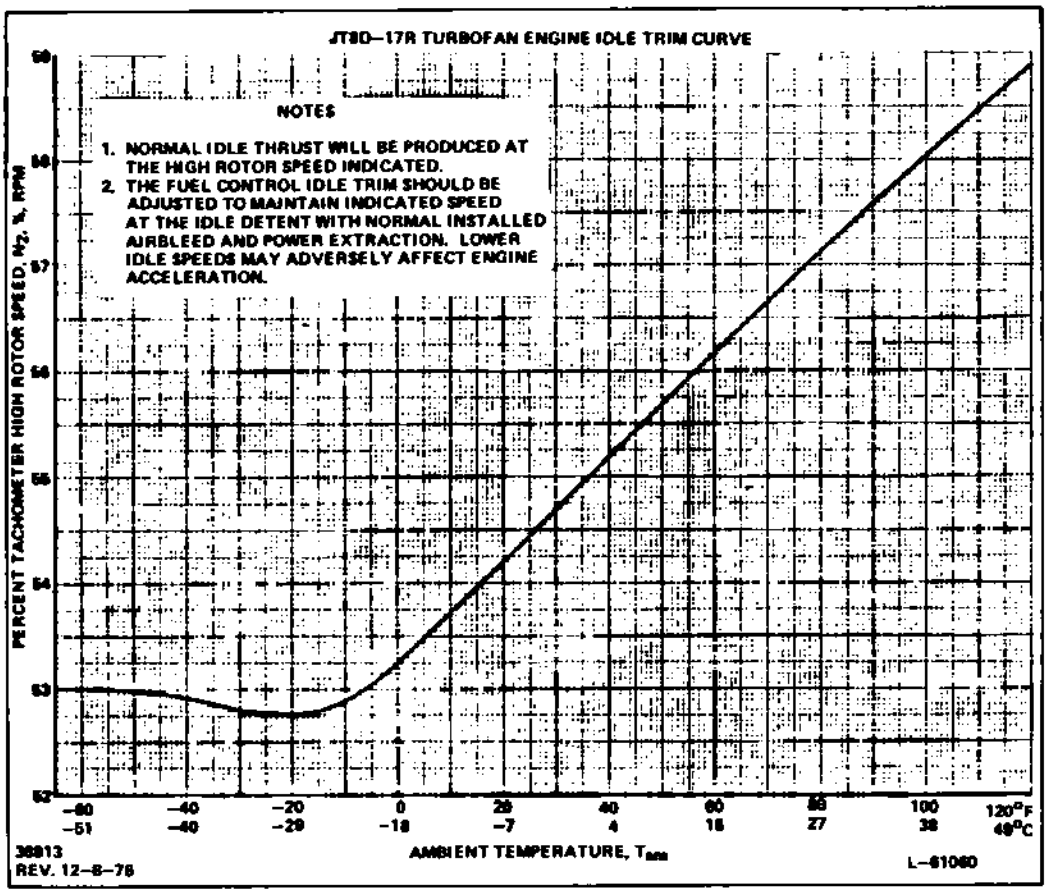
Idle Trim Curve (JT8D-15A)
Figure 504 (Sheet 4)
(Task 72-00-00-760-008)



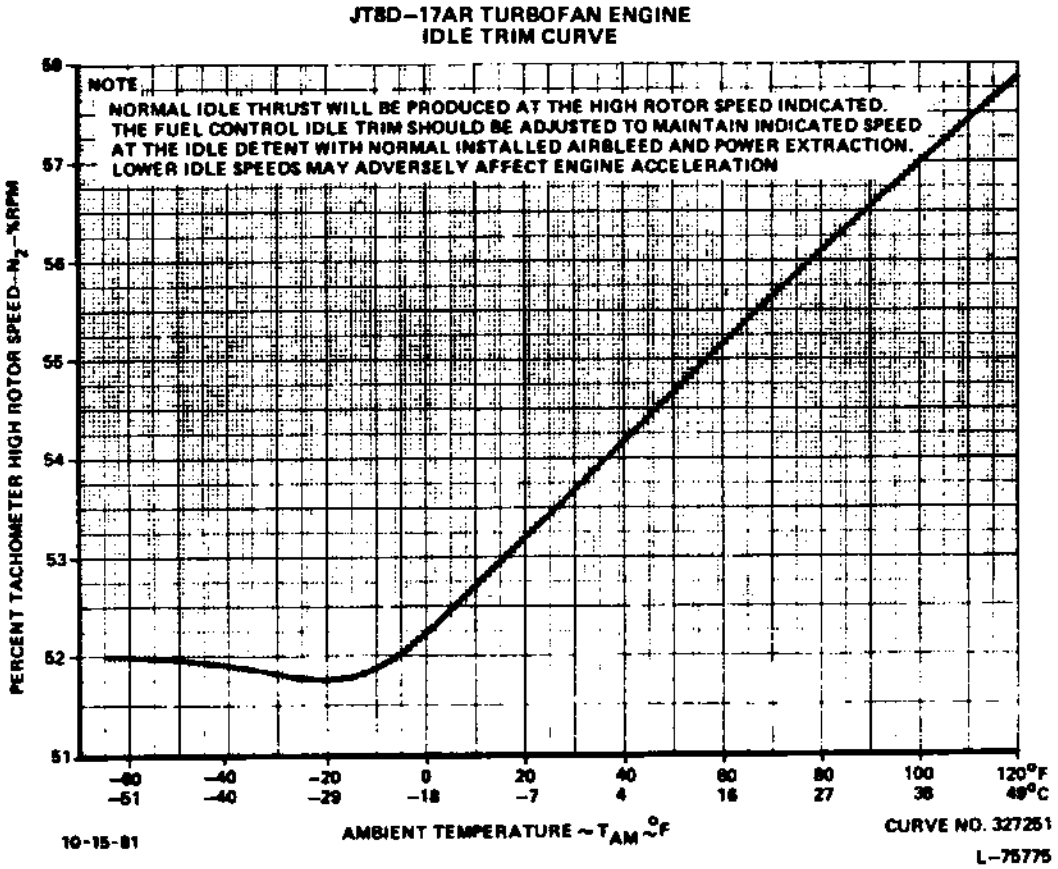
Idle Trim Curve (JT8D-17)
Figure 504 (Sheet 5)
(Task 72-00-00-760-008)



Idle Trim Curve (JT8D-17A)
Figure 504 (Sheet 6)
(Task 72-00-00-760-008)



Idle Trim Curve (JT8D-17R)
Figure 504 (Sheet 7)
(Task 72-00-00-760-008)



Idle Trim Curve (JT8D-17AR)
Figure 504 (Sheet 8)
(Task 72-00-00-760-008)

N2 CORRECTION

(1) $\text{Corrected N2 (\%)} = \dfrac{\text{Observed N2 (\%)}}{\sqrt{\theta}}$

Where: $\sqrt{\theta} = \sqrt{\dfrac{\text{Compressor Inlet Temperature } ^\circ K}{288}}$

(2) From Figure 505 determine N2 correction factor ($\sqrt{\theta}$) for compressor inlet temperature.

(3) Divide observed N2 speed by $\sqrt{\theta}$.

Example: Inlet temperature = 30° C (86° F)

$\sqrt{\theta}$ (From Table 505) = 1.026

Observed N2 = 87.5%

$\text{Corrected N2} = \dfrac{\text{Observed N2 (\%)}}{\sqrt{\theta}} \quad \dfrac{87.5\%}{= 1.026} = 85.3\%$

L-74146

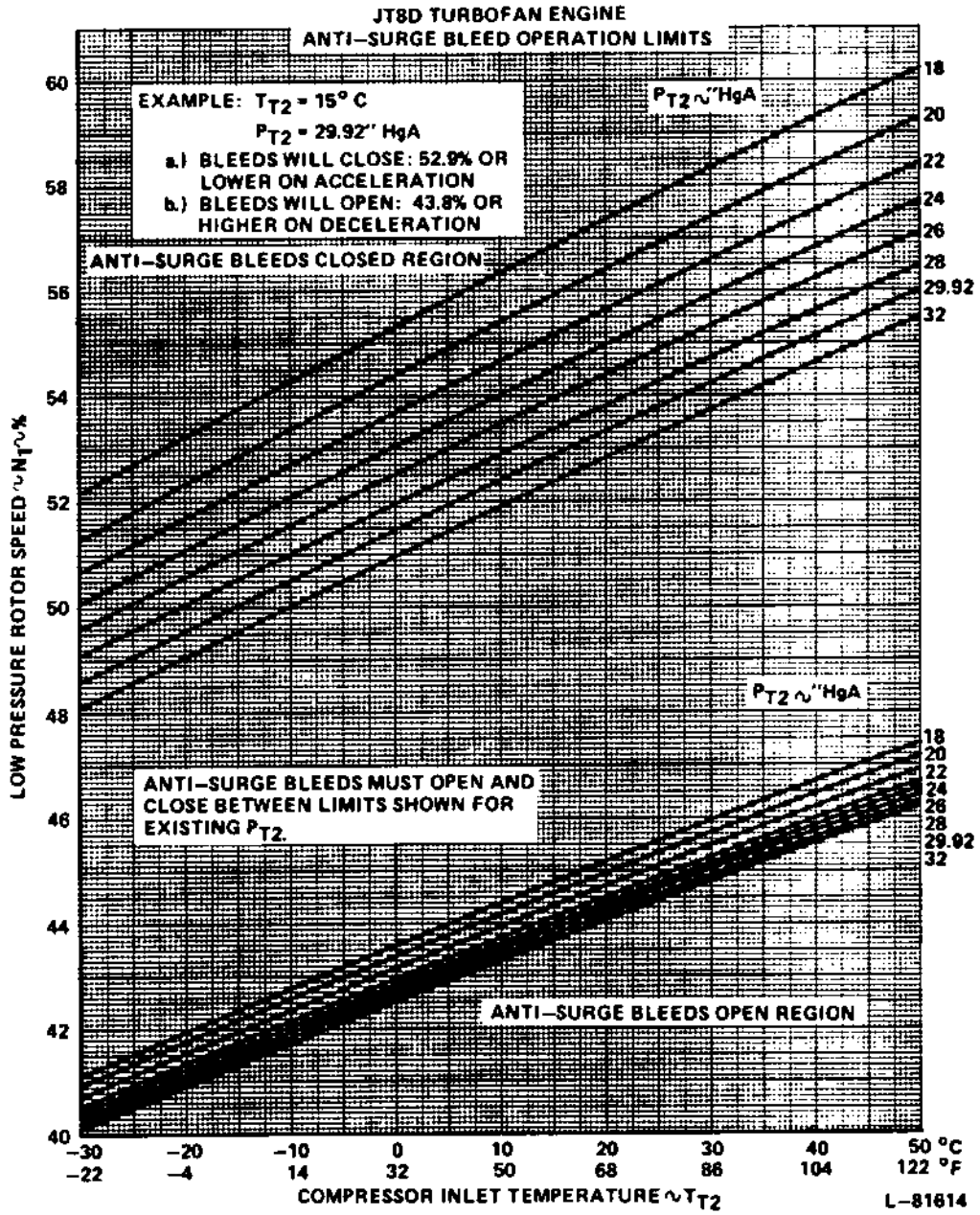
Rotor Speed Correction
Figure 505
(Task 72-00-00-760-008)

ROTOR SPEED CORRECTION FACTOR

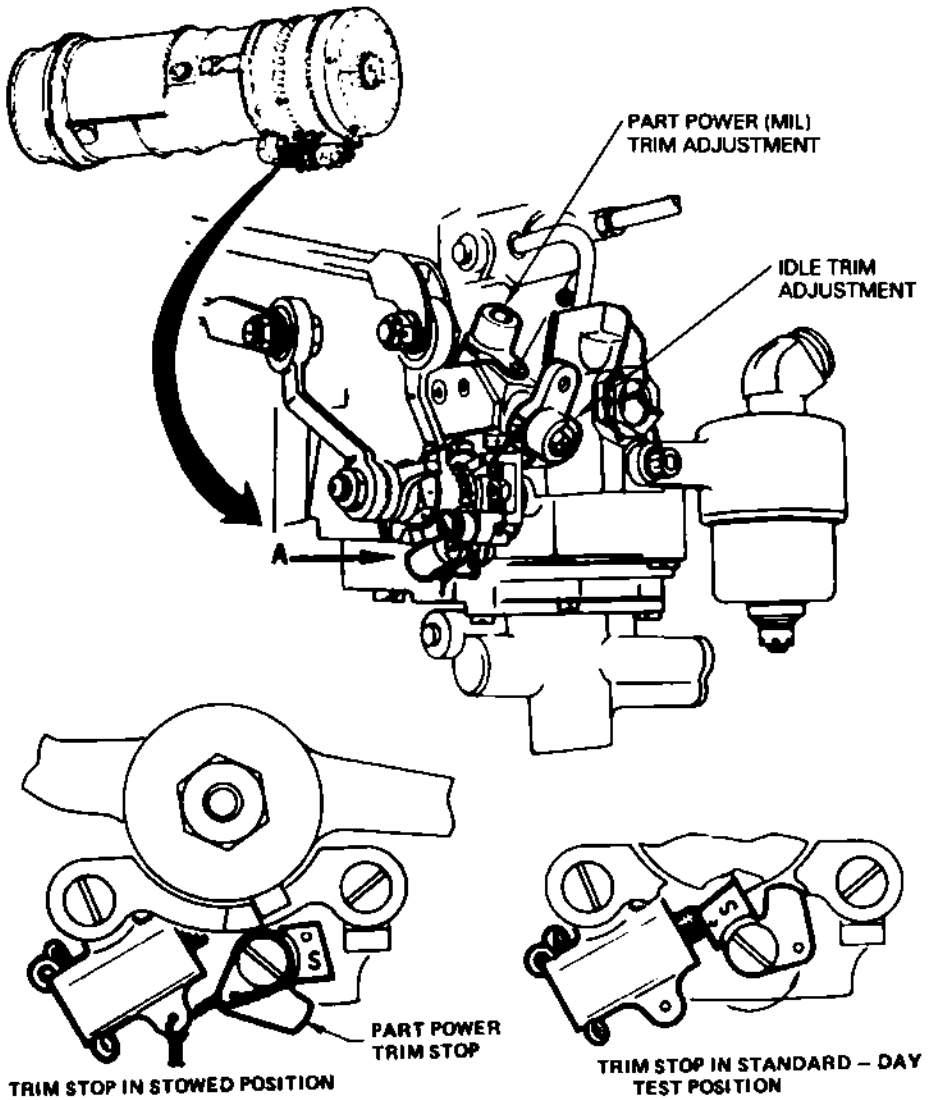
T_{t2} °C	T_{t2} (°F)	$\sqrt{\theta}$	T_{t2} °C	T_{t2} (°F)	$\sqrt{\theta}$	T_{t2} °C	T_{t2} (°F)	$\sqrt{\theta}$
48.3	119	1.056	15.0	59	1.000	−18.3	−1	0.940
47.8	118	1.055	14.4	58	0.999	−18.9	−2	0.939
47.2	117	1.054	13.9	57	0.998	−19.4	−3	0.938
46.7	116	1.054	13.3	56	0.997	−20.0	−4	0.937
46.1	115	1.053	12.8	55	0.996	−20.6	−5	0.936
45.6	114	1.052	12.3	54	0.995	−21.1	−6	0.935
45.0	113	1.051	11.7	53	0.994	−21.7	−7	0.934
44.4	112	1.050	11.1	52	0.993	−22.2	−8	0.933
43.9	111	1.049	10.6	51	0.992	−22.8	−9	0.932
43.3	110	1.048	10.0	50	0.991			
42.8	109	1.047	9.4	49	0.990	−23.3	−10	0.931
42.2	108	1.046	8.9	48	0.989	−23.9	−11	0.930
41.7	107	1.045	8.3	47	0.988	−24.4	−12	0.929
41.1	106	1.044	7.8	46	0.987	−25.0	−13	0.928
40.6	105	1.043	7.2	45	0.986	−25.6	−14	0.927
40.0	104	1.042	6.7	44	0.985	−26.1	−15	0.926
39.4	103	1.041	6.1	43	0.984	−26.7	−16	0.925
38.9	102	1.041	5.6	42	0.984	−27.2	−17	0.924
38.3	101	1.040	5.0	41	0.983	−27.8	−18	0.923
37.8	100	1.039	4.4	40	0.982	−28.3	−19	0.922
37.2	99	1.038	3.9	39	0.981	−28.9	−20	0.921
36.7	98	1.037	3.3	38	0.980	−29.4	−21	0.920
36.1	97	1.036	2.8	37	0.979	−30.0	−22	0.919
35.6	96	1.035	2.2	36	0.978	−30.6	−23	0.918
35.0	95	1.034	1.7	35	0.977	−31.1	−24	0.917
34.4	94	1.033	1.1	34	0.976	−31.7	−25	0.916
33.9	93	1.032	0.6	33	0.975	−32.2	−26	0.914
33.3	92	1.031	0.0	32	0.974	−32.8	−27	0.913
32.8	91	1.030	−0.6	31	0.973	−33.3	−28	0.912
32.2	90	1.029	−1.1	30	0.972	−33.9	−29	0.911
31.7	89	1.029	−1.7	29	0.971	−34.4	−30	0.910
31.1	88	1.028	−2.2	28	0.970	−35.0	−31	0.909
30.6	87	1.027	−2.8	27	0.969	−35.6	−32	0.908
30.0	86	1.026	−3.3	26	0.968	−36.1	−33	0.907
29.4	85	1.025	−3.9	25	0.967	−36.7	−34	0.906
28.9	84	1.024	−4.4	24	0.966	−37.2	−35	0.905
28.3	83	1.023	−5.0	23	0.965	−37.8	−36	0.904
27.8	82	1.022	−5.6	22	0.964	−38.3	−37	0.903
27.2	81	1.021	−6.1	21	0.963	−38.9	−38	0.902
26.7	80	1.020	−6.7	20	0.962	−39.4	−39	0.901
26.1	79	1.019	−7.2	19	0.961	−40.0	−40	0.900
25.6	78	1.018	−7.8	18	0.960	−40.6	−41	0.899
25.0	77	1.017	−8.3	17	0.959	−41.1	−42	0.897
24.4	76	1.016	−8.9	16	0.958	−41.7	−43	0.896
23.9	75	1.015	−9.4	15	0.957	−42.2	−44	0.895
23.3	74	1.014	−10.0	14	0.956	−42.8	−45	0.894
22.8	73	1.013	−10.6	13	0.955	−43.3	−46	0.893
22.2	72	1.012	−11.1	12	0.954	−43.9	−47	0.892
21.7	71	1.012	−11.7	11	0.953	−44.4	−48	0.891
21.1	70	1.011	−12.2	10	0.952	−45.0	−49	0.890
20.6	69	1.010	−12.8	9	0.951	−45.6	−50	0.889
20.0	68	1.009	−13.3	8	0.950	−46.1	−51	0.888
19.4	67	1.008	−13.9	7	0.949	−46.7	−52	0.887
18.9	66	1.007	−14.4	6	0.948	−47.2	−53	0.886
18.3	65	1.006	−15.0	5	0.947	−47.8	−54	0.885
17.8	64	1.005	−15.6	4	-0.946	−48.3	−55	0.883
17.2	63	1.004	−16.1	3	0.945	−48.9	−56	0.882
16.7	62	1.003	−16.7	2	0.944	−49.4	−57	0.881
16.1	61	1.002	−17.2	1	0.943	−50.0	−58	0.880
15.6	60	1.001	−17.8	0	0.942	−50.6	−59	0.879

1-11336

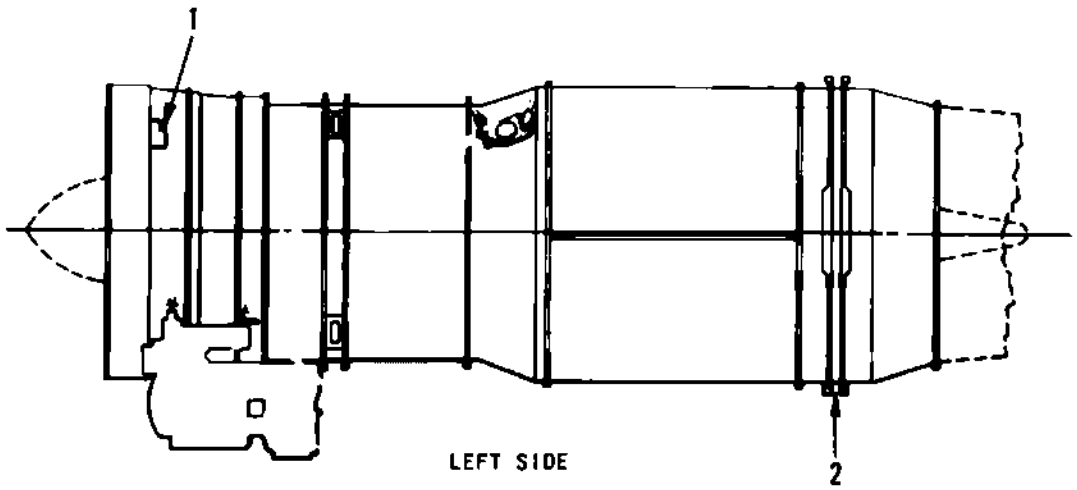
Rotor Speed Correction
Factor Chart
Figure 506
(Task 72-00-00-760-008)



Anti-Surge Bleed Chart
Figure 507
(Task 72-00-00-760-008)



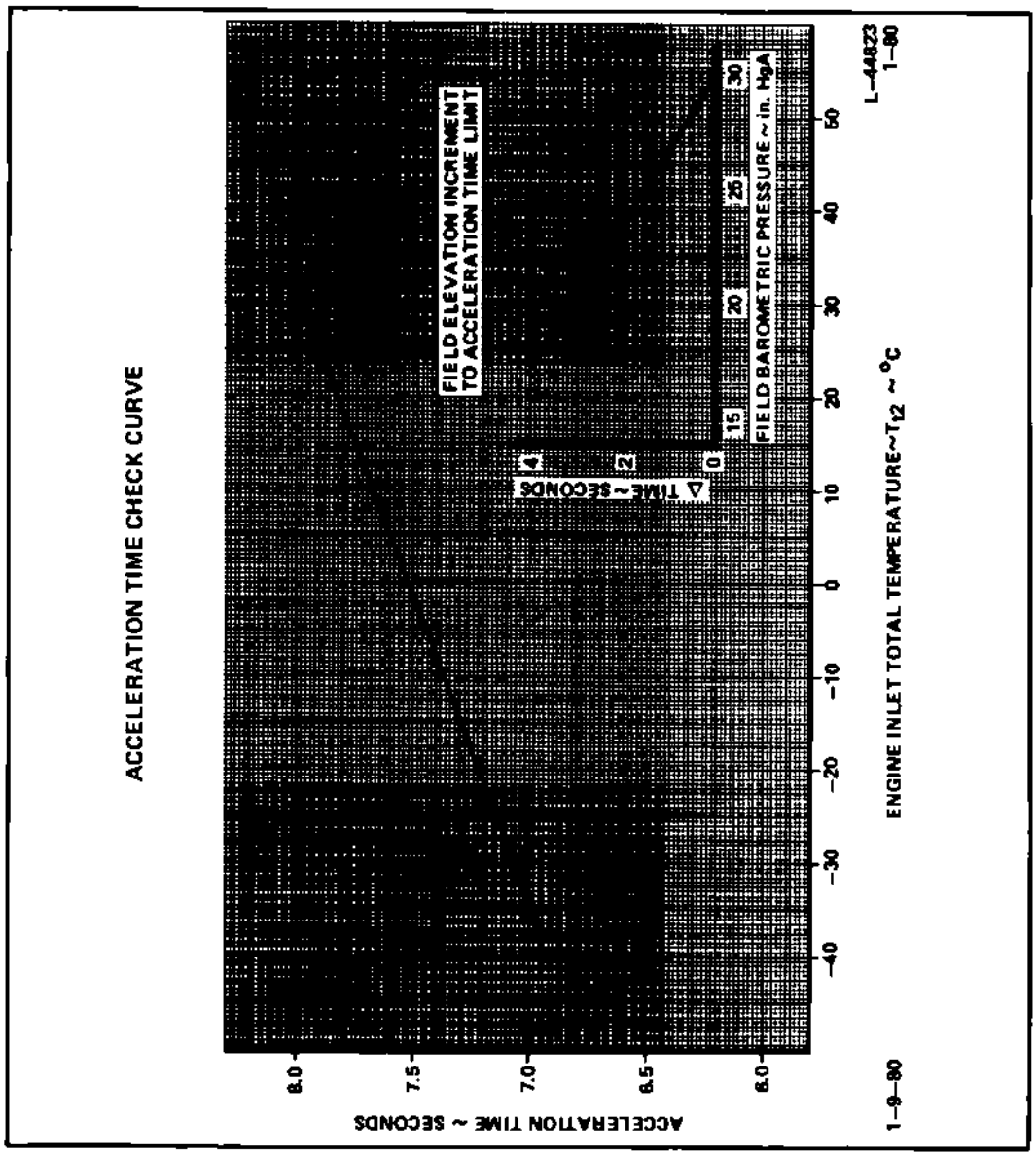
Part Power Trim Stop Positioning
Figure 508
(Task 72-00-00-760-008)



1. INLET PICKUP LOCATION
2. REAR PICKUP LOCATION

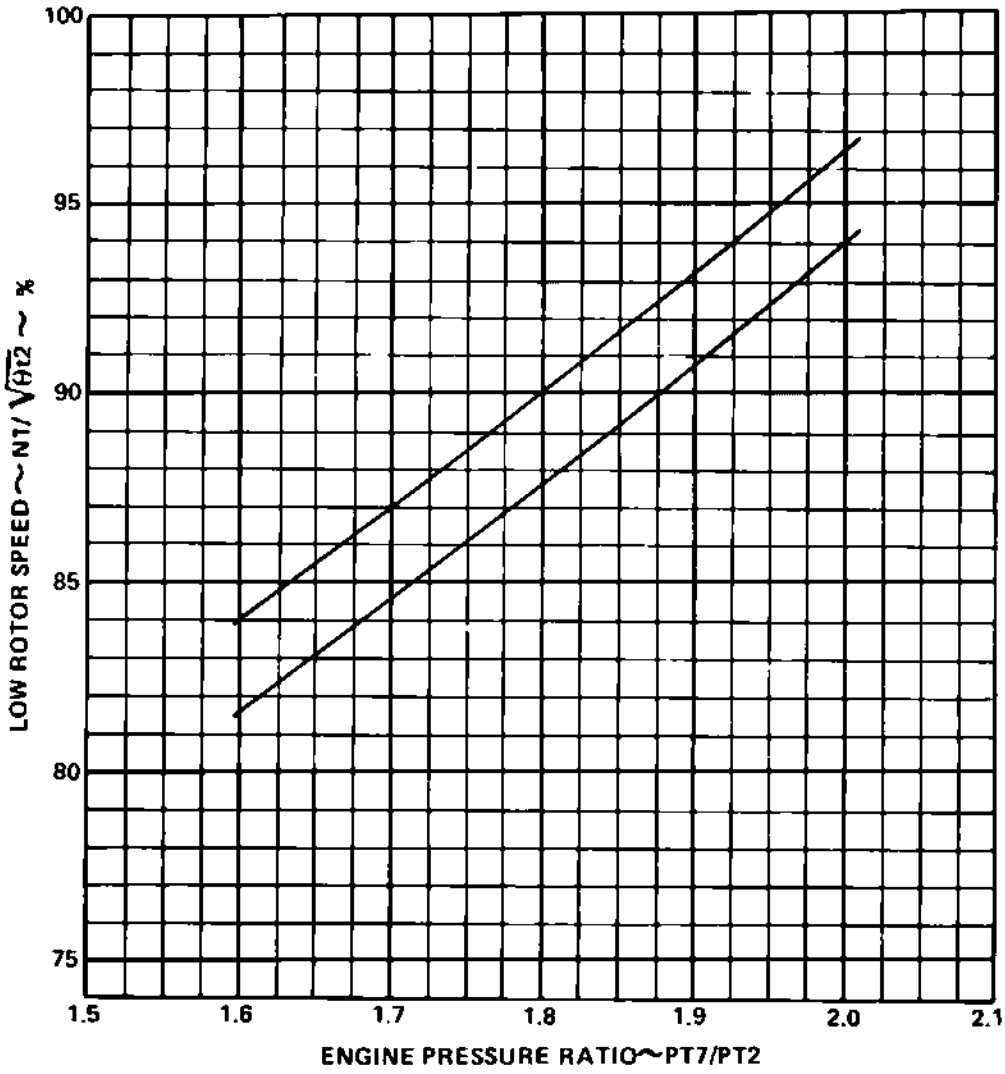
L—74149

Location Of Vibration Pickups
Figure 509
(Task 72-00-00-760-008)



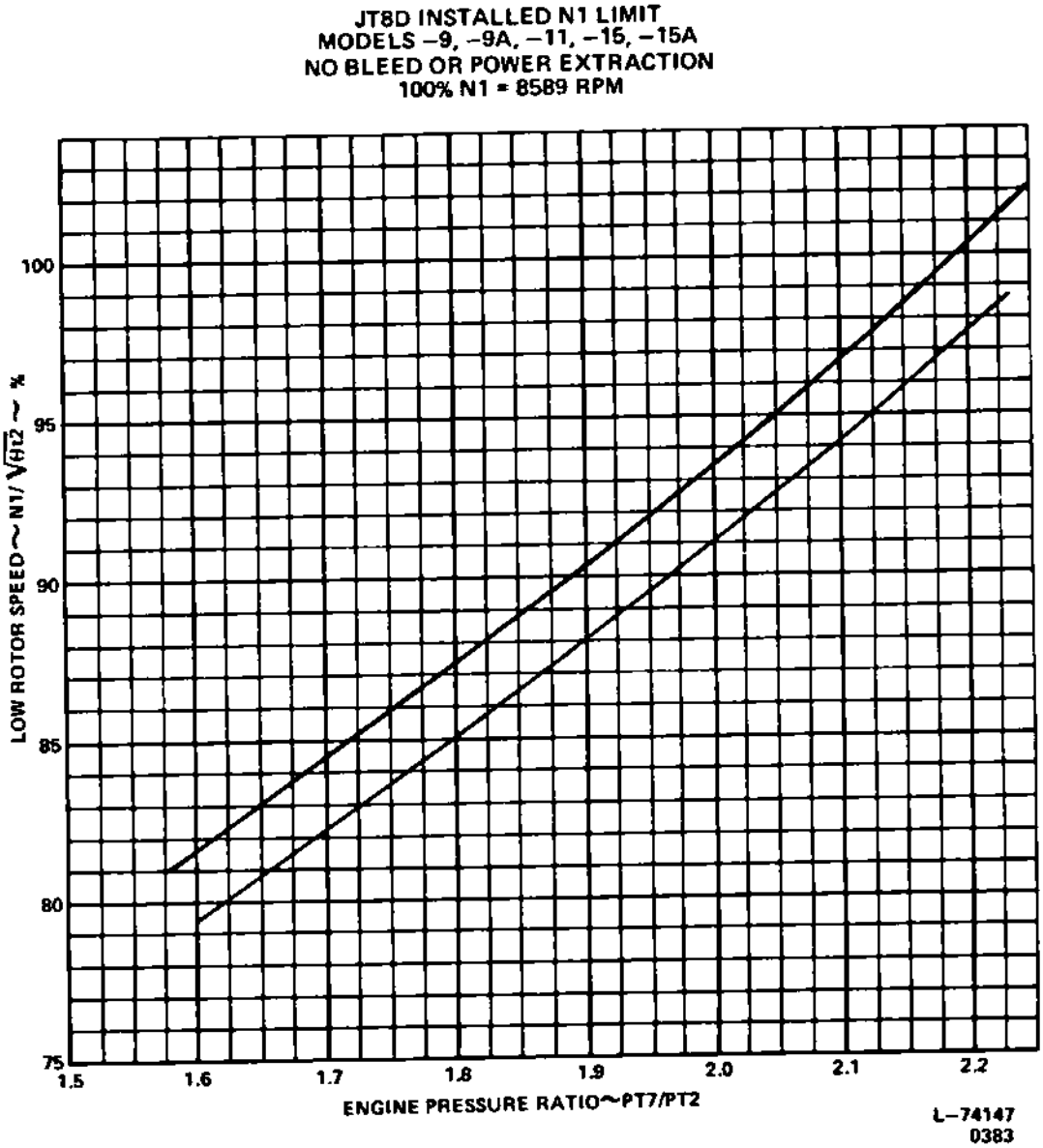
Acceleration Time Check Curve
Figure 510
(Task 72-00-00-760-008)

JT8D INSTALLED N1 LIMIT
MODELS –1,–1A,–1B,–7,–7A,–7B
NO BLEED OR POWER EXTRACTION
100% N1 = 8589 RPM



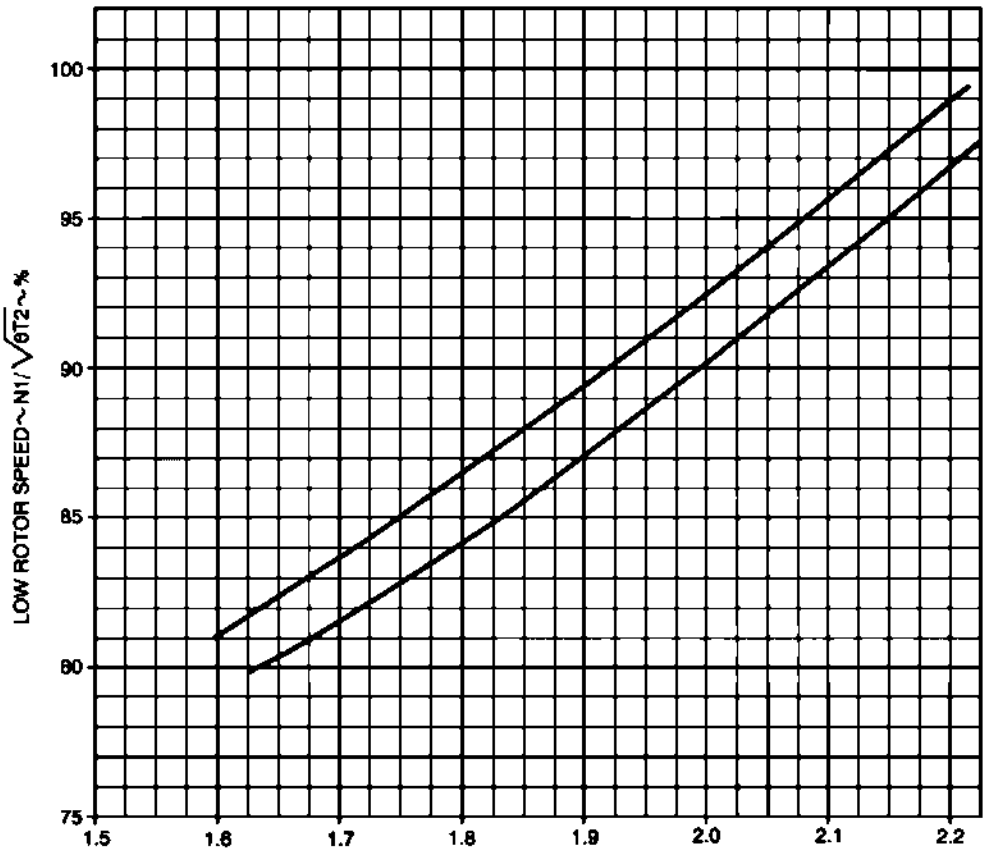
L–80162

Low Rotor Speed Versus
Engine Pressure Ratio
Figure 511 (Sheet 1)
(Task 72-00-00-760-008)



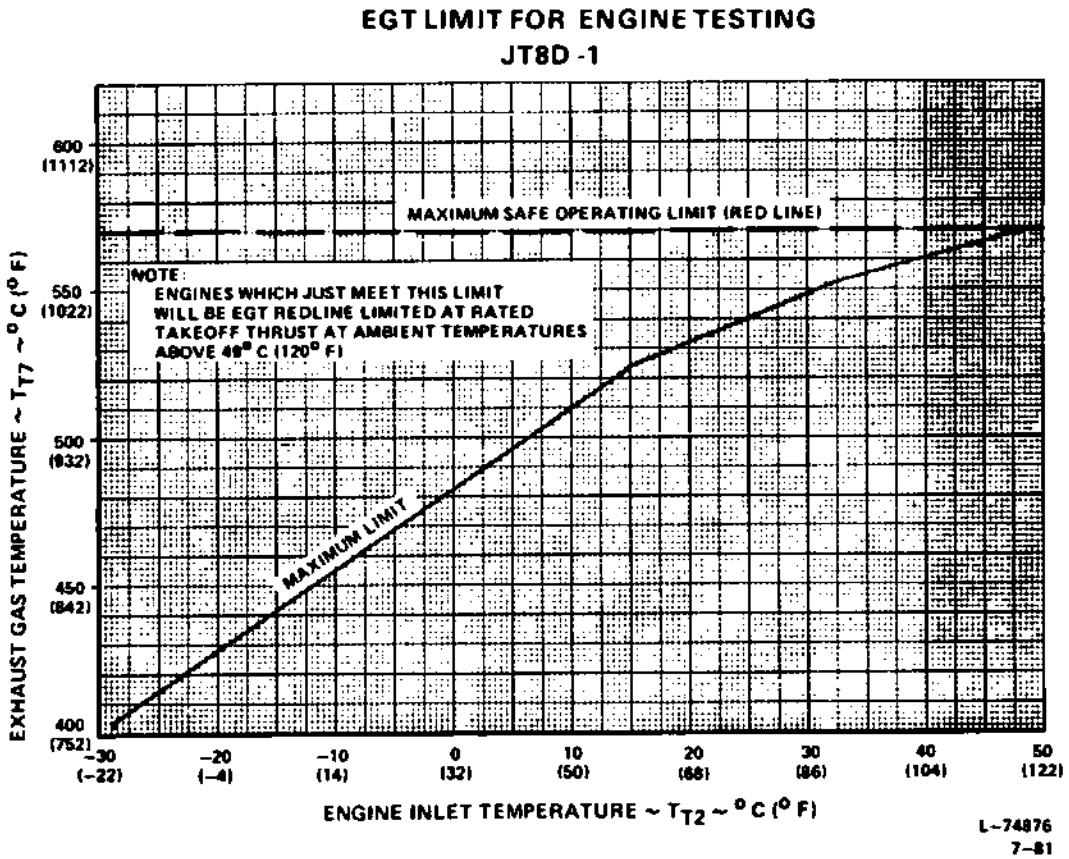
Low Rotor Speed Versus
Engine Pressure Ratio
Figure 511 (Sheet 2)
(Task 72-00-00-760-008)

JT8D INSTALLED N1 LIMIT
MODELS -17, -17A, -17R, -17AR
NO BLEED OR POWER EXTRACTION
100% N1 = 8589 RPM



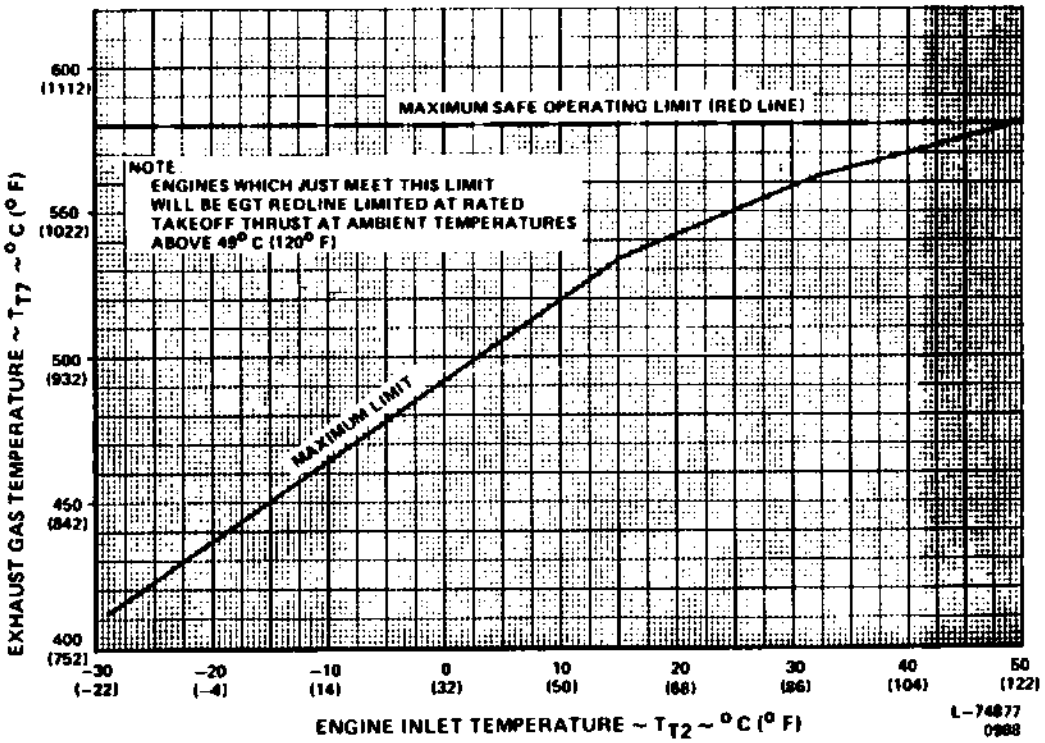
L-74148 (1008)
PW V

Low Rotor Speed Versus
Engine Pressure Ratio
Figure 511 (Sheet 3)
(Task 72-00-00-760-008)

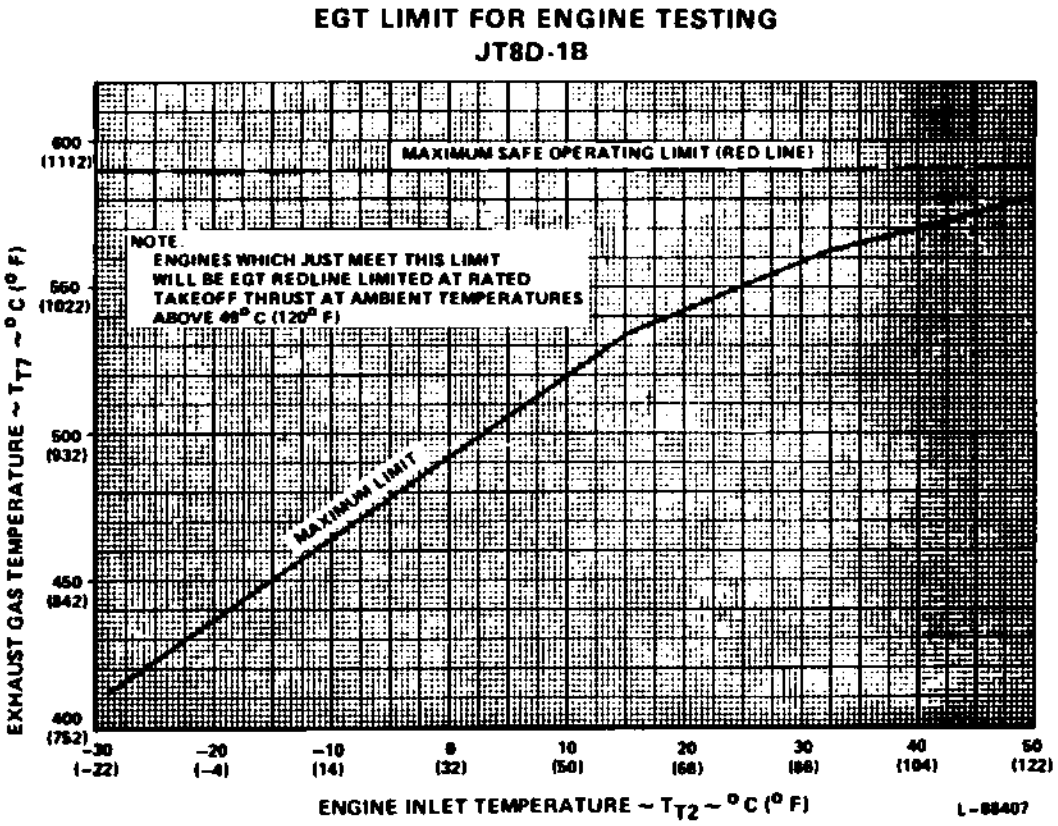


Observed EGT Limits
Figure 512 (Sheet 1)
(Task 72-00-00-760-008)

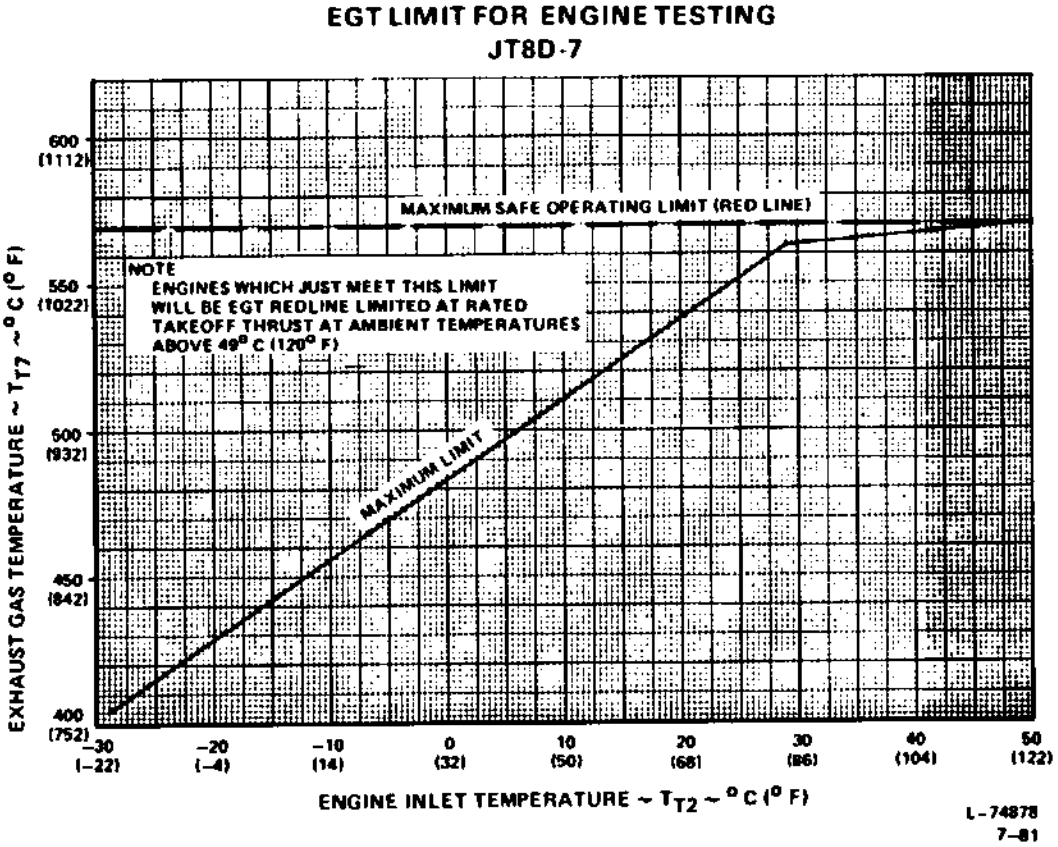
EGT LIMIT FOR ENGINE TESTING
JT8D-1A



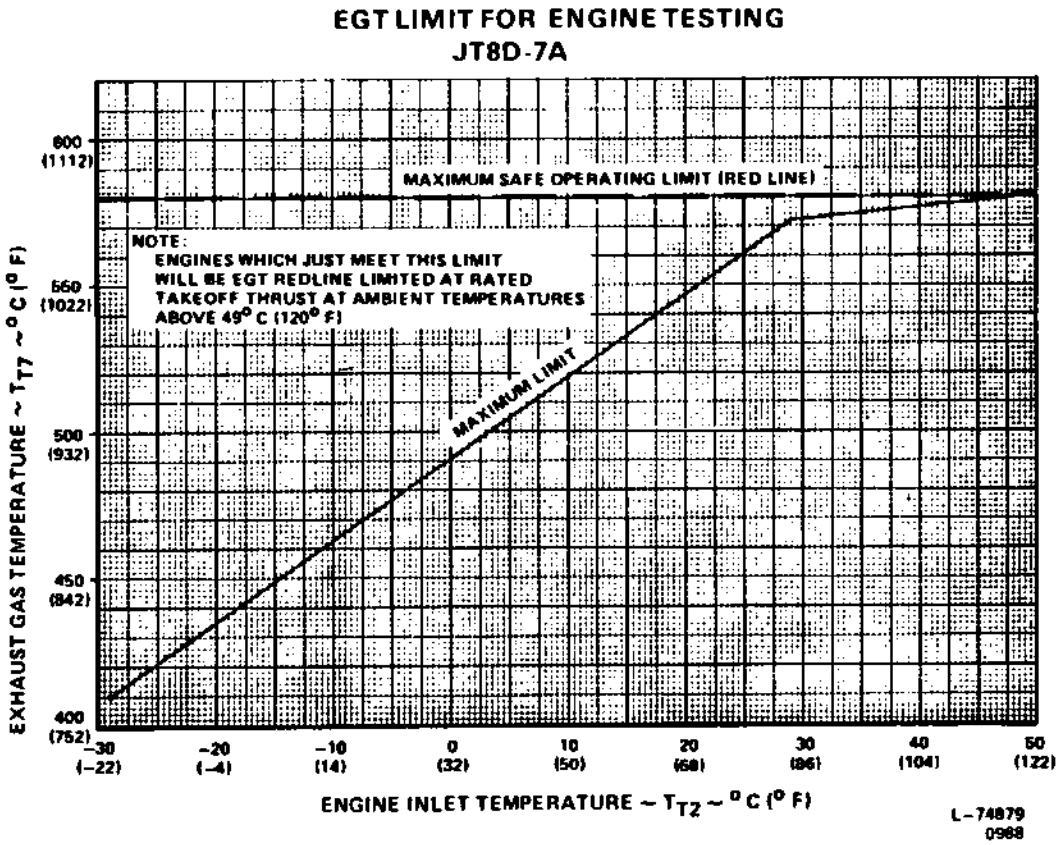
Observed EGT Limits
Figure 512 (Sheet 2)
(Task 72-00-00-760-008)



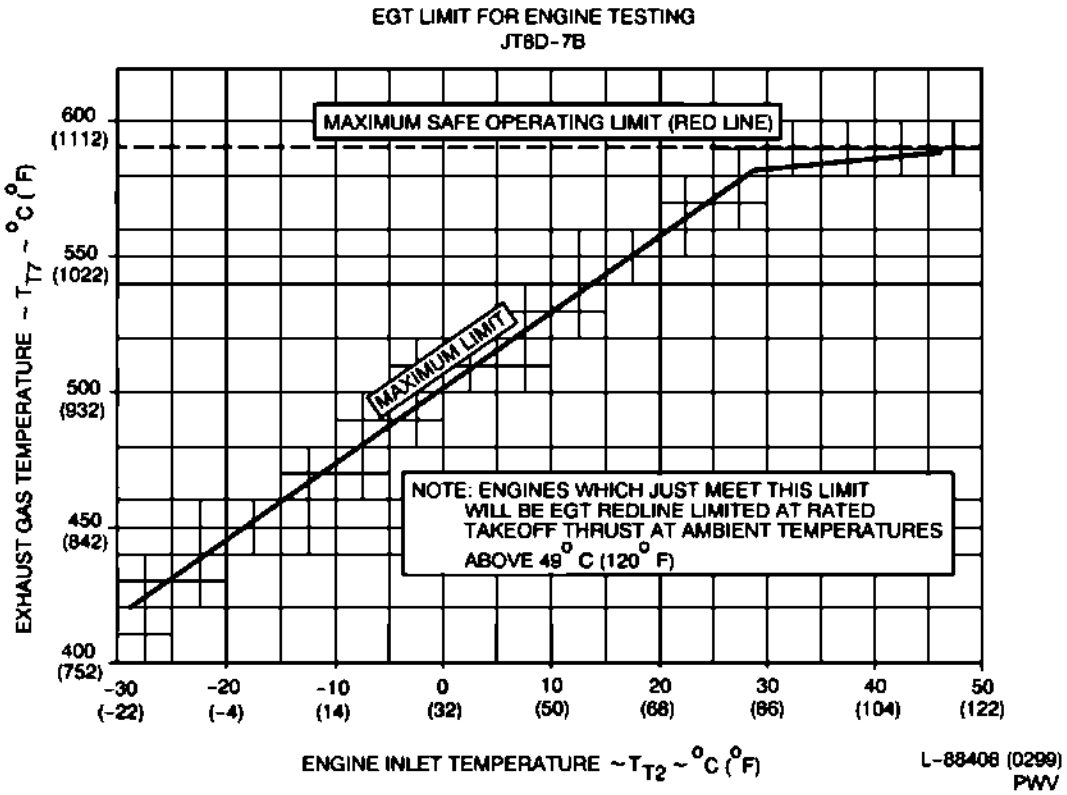
Observed EGT Limits
Figure 512 (Sheet 3)
(Task 72-00-00-760-008)



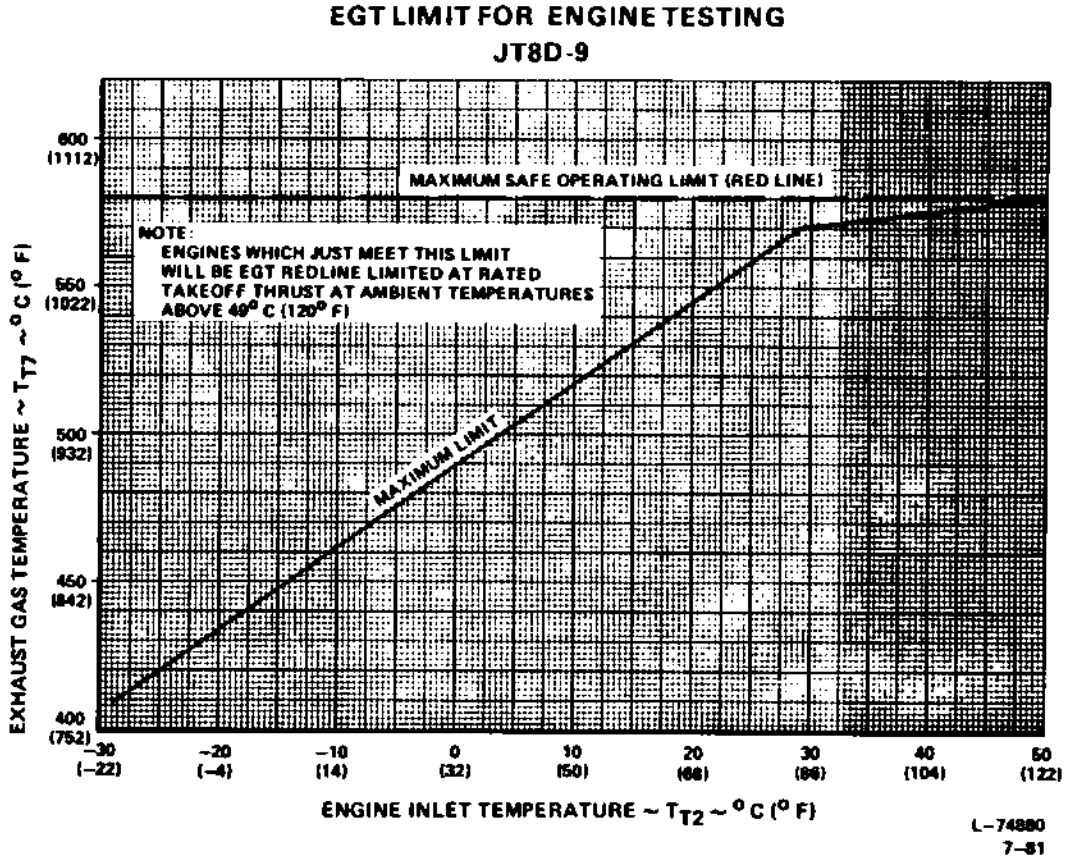
Observed EGT Limits
Figure 512 (Sheet 4)
(Task 72-00-00-760-008)



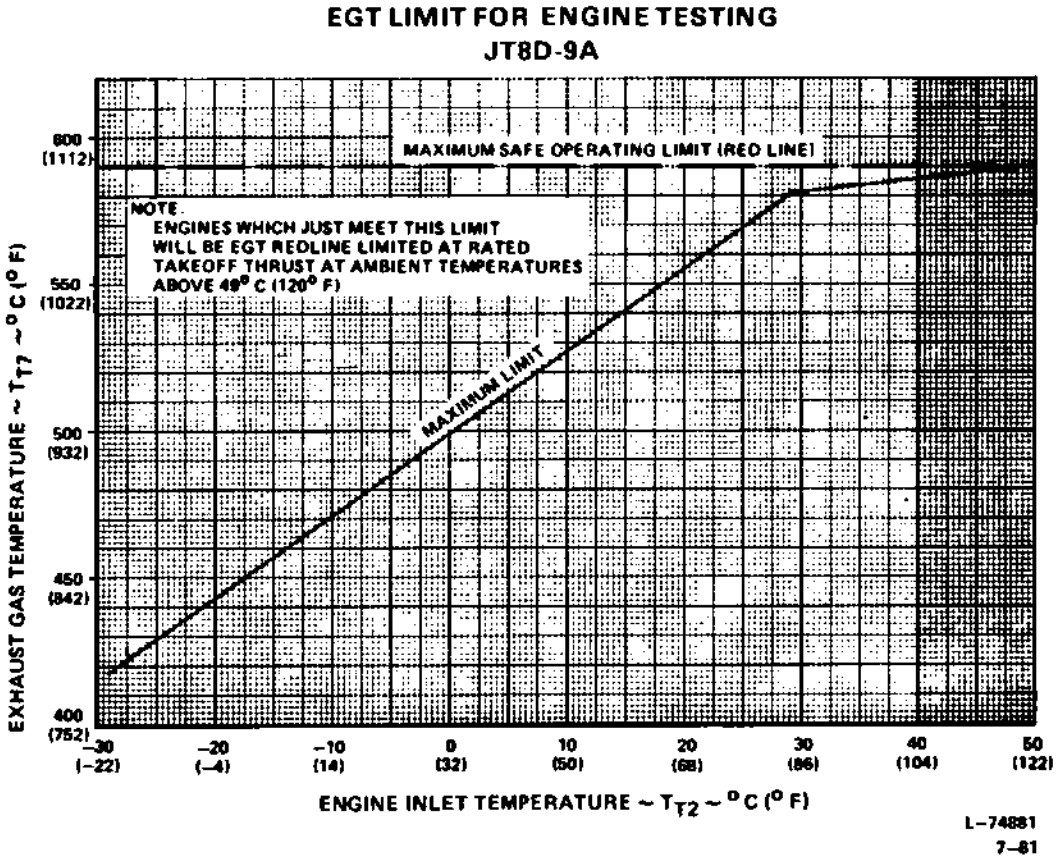
Observed EGT Limits
Figure 512 (Sheet 5)
(Task 72-00-00-760-008)



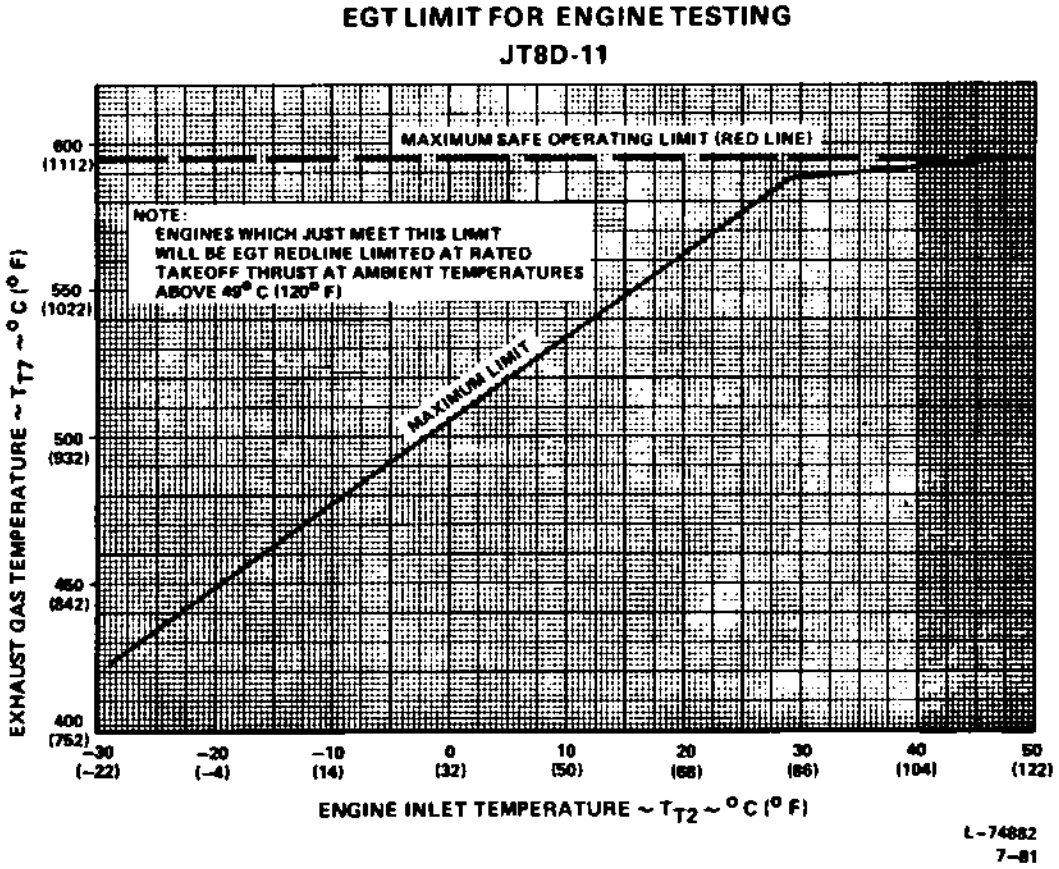
Observed EGT Limits
Figure 512 (Sheet 6)
(Task 72-00-00-760-008)



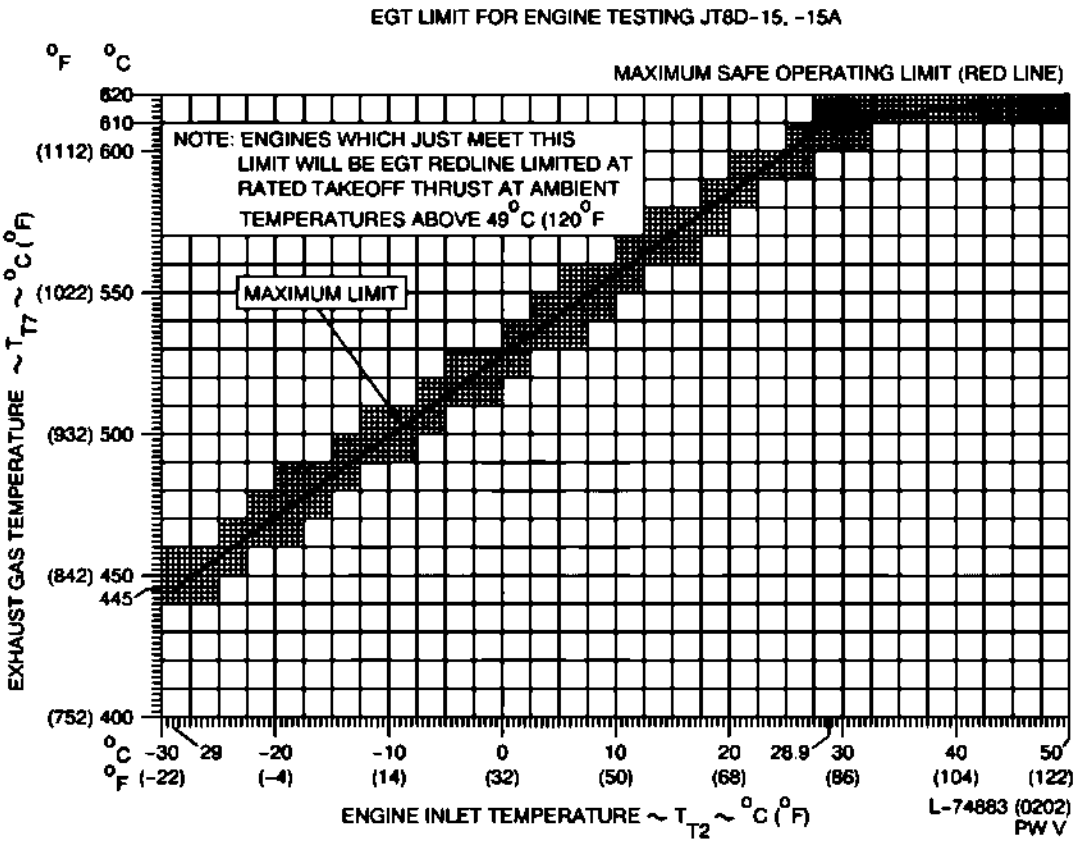
Observed EGT Limits
Figure 512 (Sheet 7)
(Task 72-00-00-760-008)



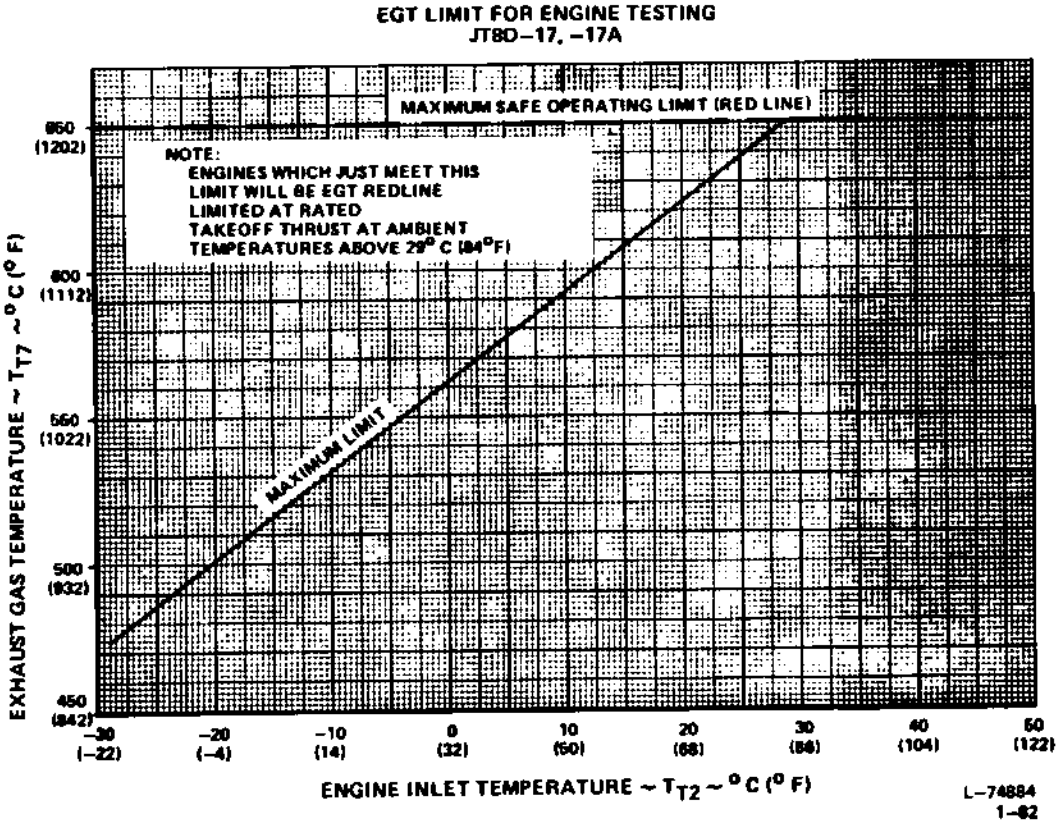
Observed EGT Limits
Figure 512 (Sheet 8)
(Task 72-00-00-760-008)



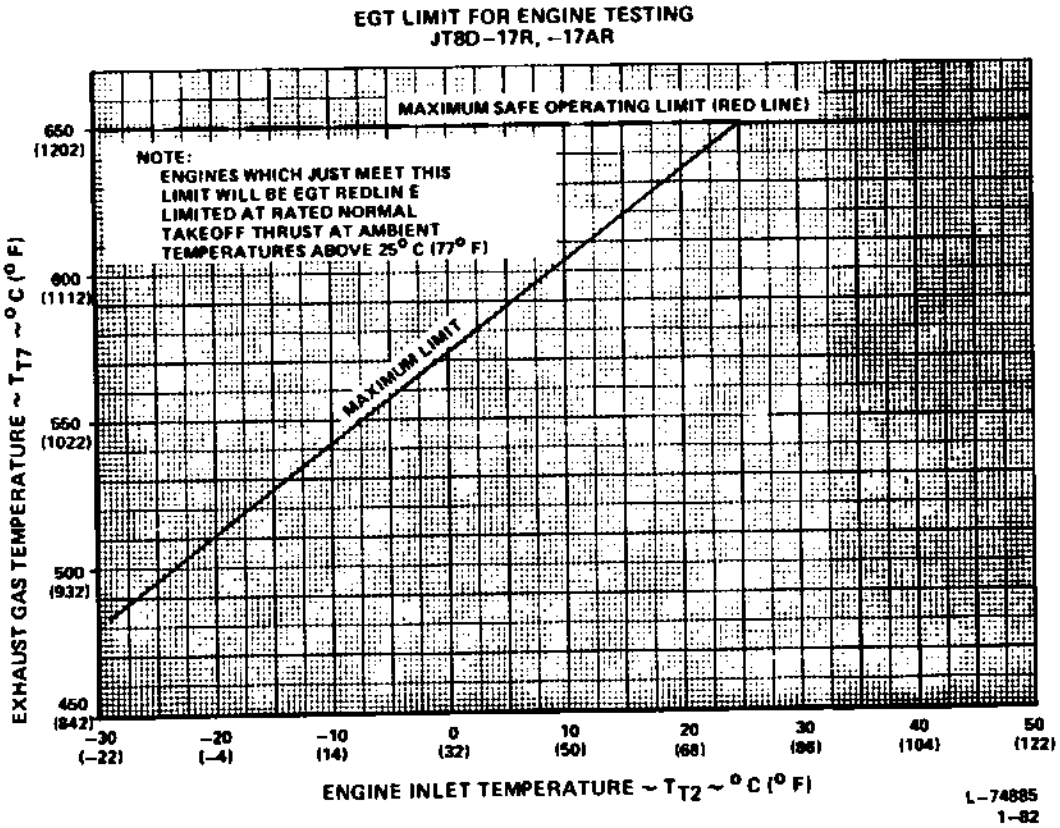
Observed EGT Limits
Figure 512 (Sheet 9)
(Task 72-00-00-760-008)


EGT LIMIT FOR ENGINE TESTING JT8D-15, -15A
MAXIMUM SAFE OPERATING LIMIT (RED LINE)
NOTE: ENGINES WHICH JUST MEET THIS LIMIT WILL BE EGT REDLINE LIMITED AT RATED TAKEOFF THRUST AT AMBIENT TEMPERATURES ABOVE 49°C (120°F
MAXIMUM LIMIT
°F °C
620
610
(1112) 600
(1022) 550
(932) 500
(842) 450
445
(752) 400
EXHAUST GAS TEMPERATURE ~ T_{T7} ~ °C (°F)
°C -30 -29 -20 -10 0 10 20 28.9 30 40 50
°F (-22) (-4) (14) (32) (50) (68) (86) (104) (122)
ENGINE INLET TEMPERATURE ~ T_{T2} ~ °C (°F)
L-74883 (0202)
PW V

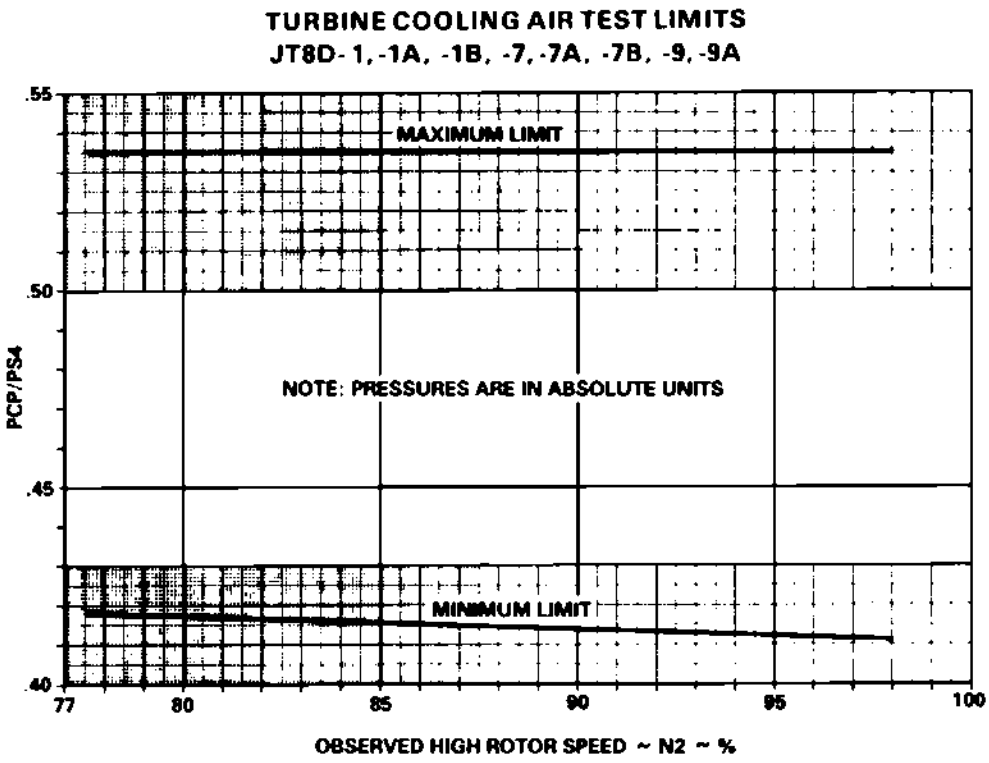
Observed EGT Limits
Figure 512 (Sheet 10)
(Task 72-00-00-760-008)



Observed EGT Limits
Figure 512 (Sheet 11)
(Task 72-00-00-760-008)

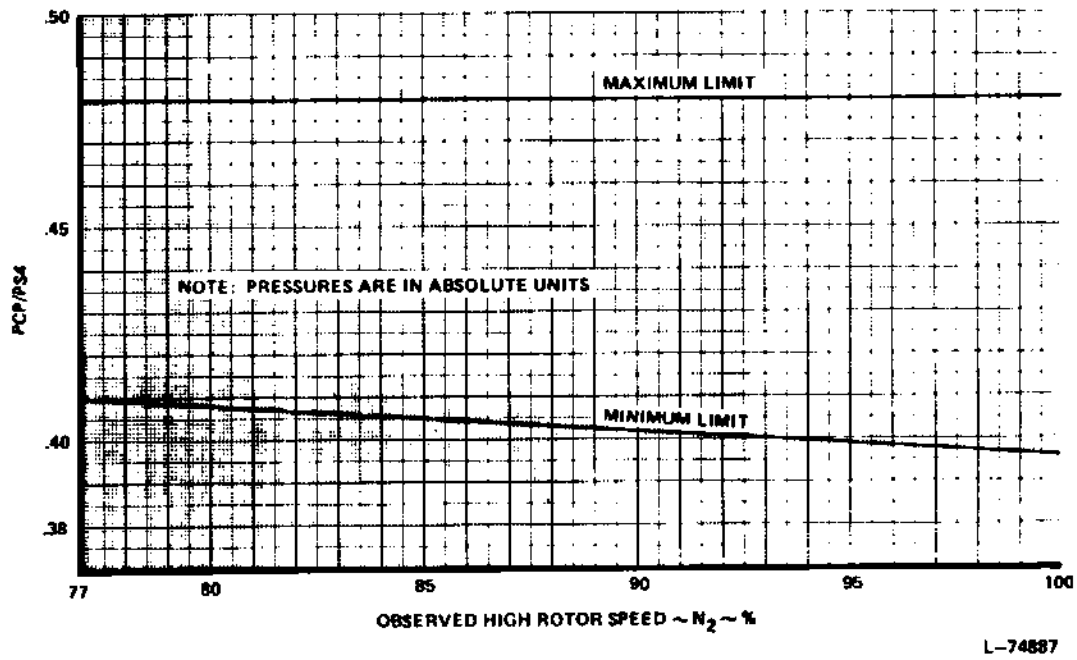


Observed EGT Limits
Figure 512 (Sheet 12)
(Task 72-00-00-760-008)

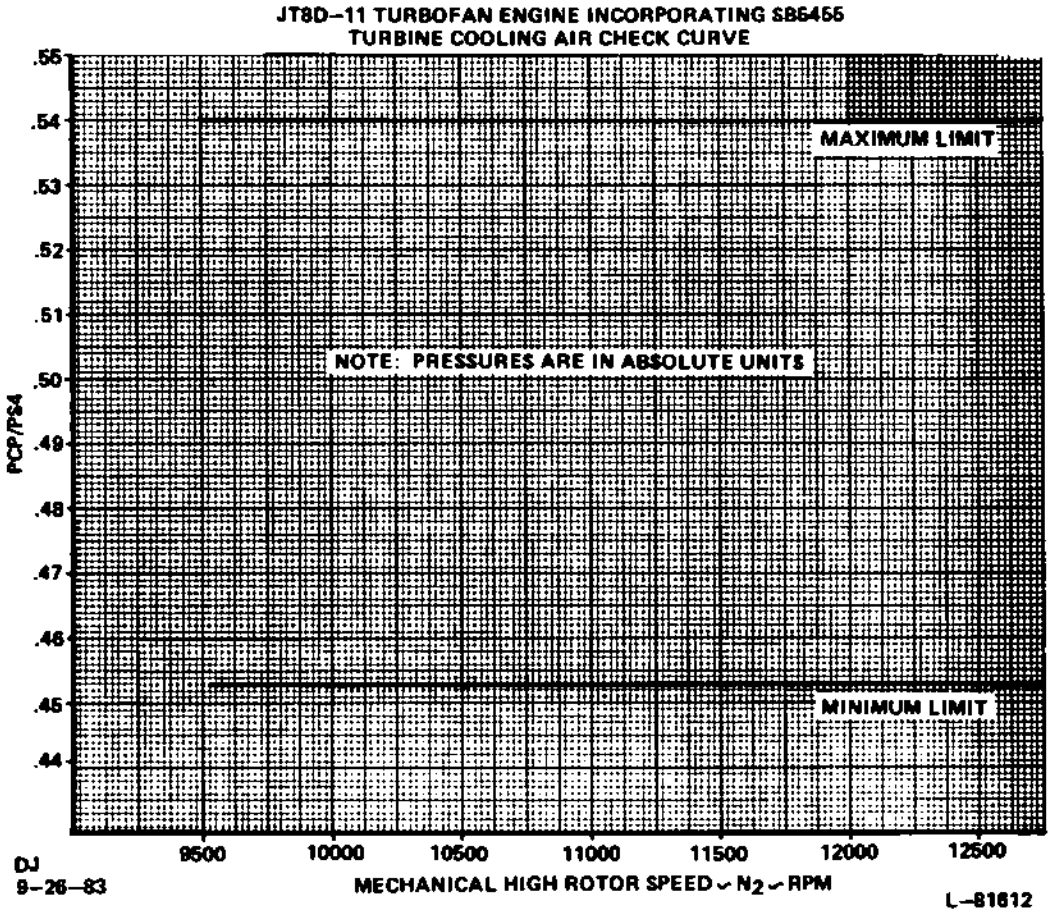


Turbine Cooling Air Test Limits
Figure 513 (Sheet 1)
(Task 72-00-00-760-008)

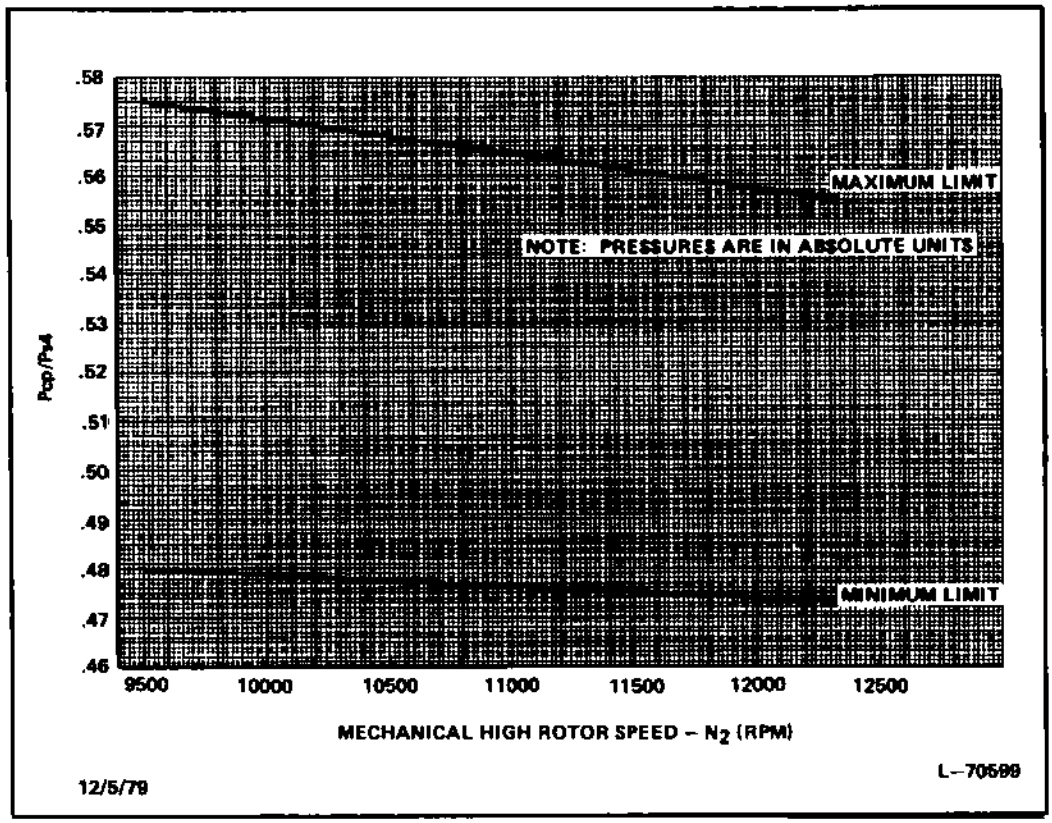
TURBINE COOLING AIR TEST LIMITS
JT8D-11



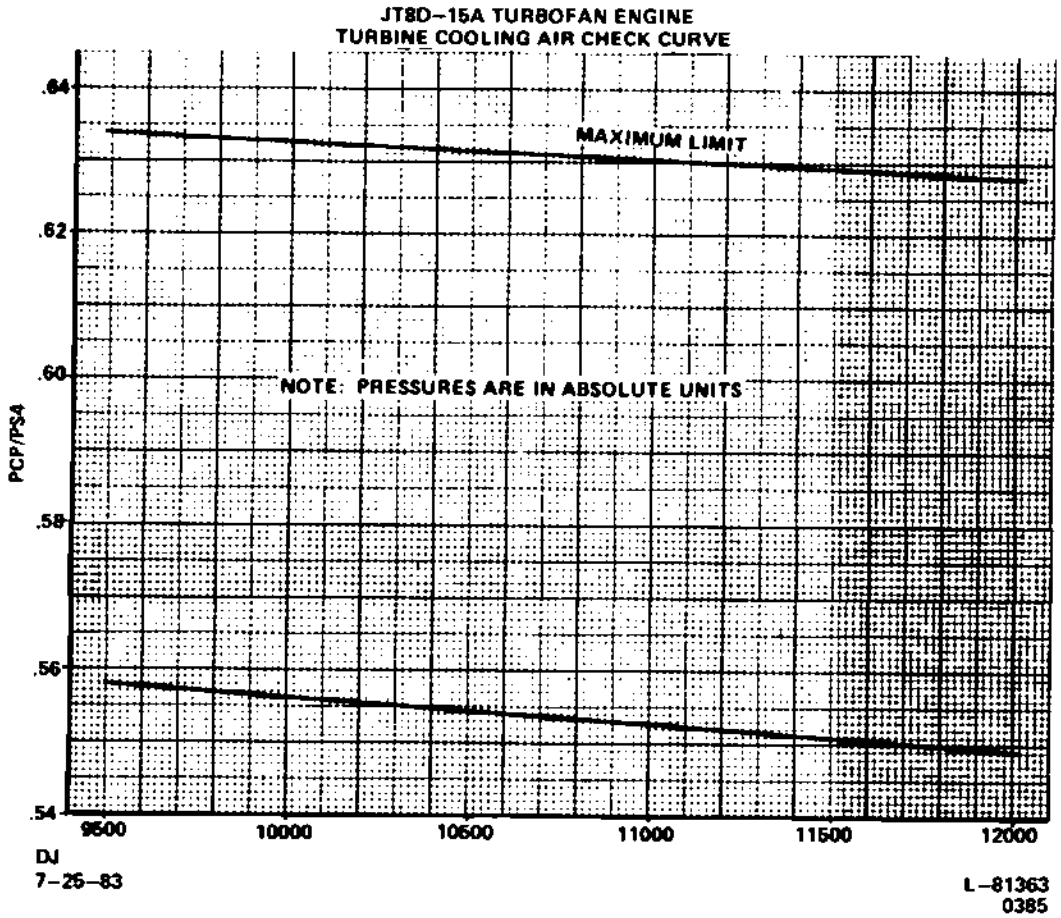
Turbine Cooling Air Test Limits
Figure 513 (Sheet 2)
(Task 72-00-00-760-008)



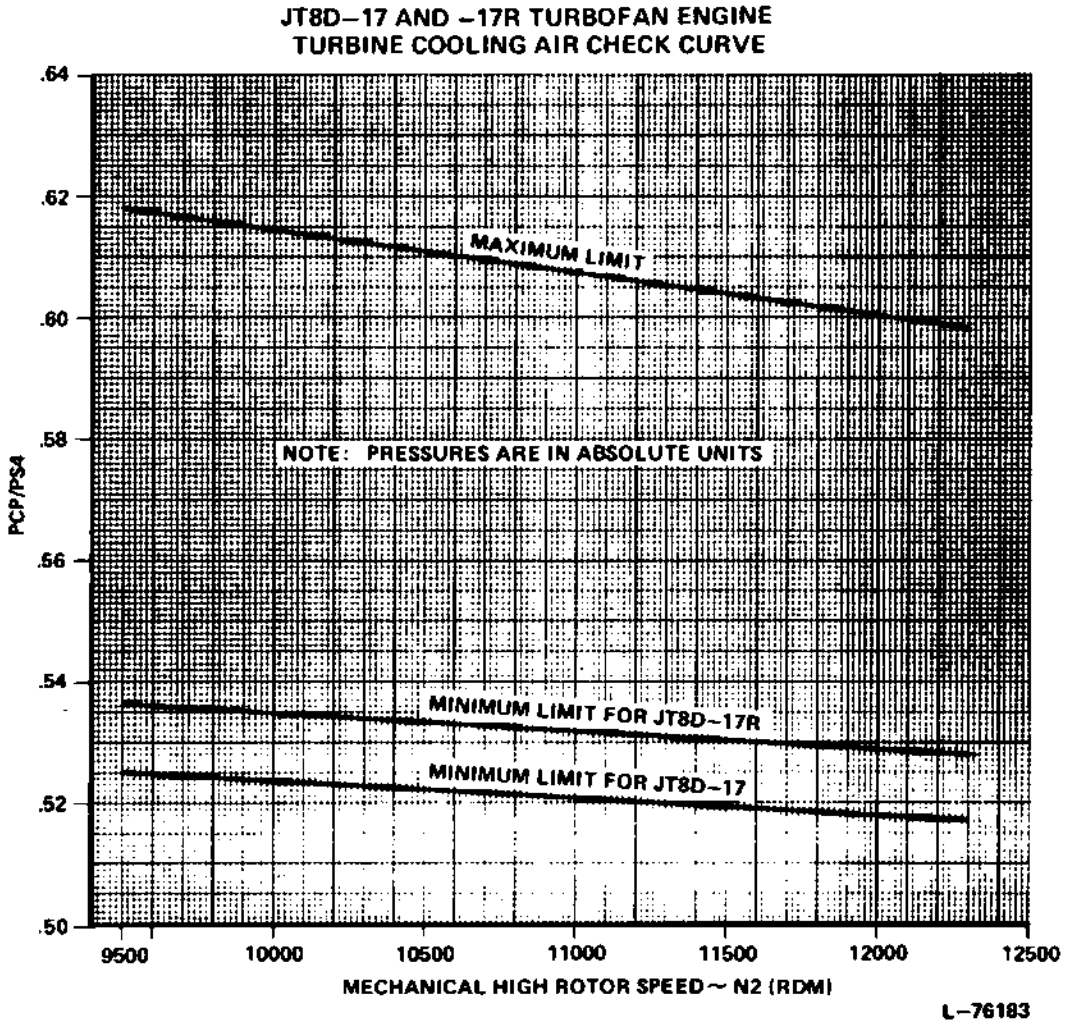
Turbine Cooling Air Test Limits
Figure 513 (Sheet 3)
(Task 72-00-00-760-008)



Turbine Cooling Air
Test Limits (JT8D-15)
Figure 513 (Sheet 4)
(Task 72-00-00-760-008)

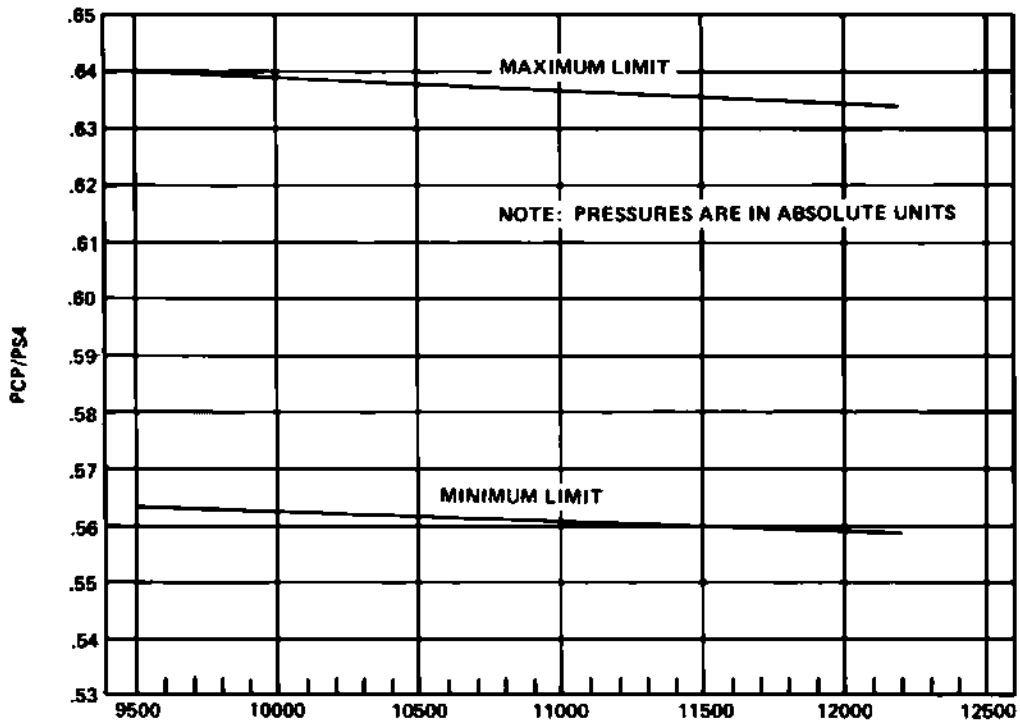


Turbine Cooling Air Test Limits
Figure 513 (Sheet 5)
(Task 72-00-00-760-008)



Turbine Cooling Air Test Limits
Figure 513 (Sheet 6)
(Task 72-00-00-760-008)

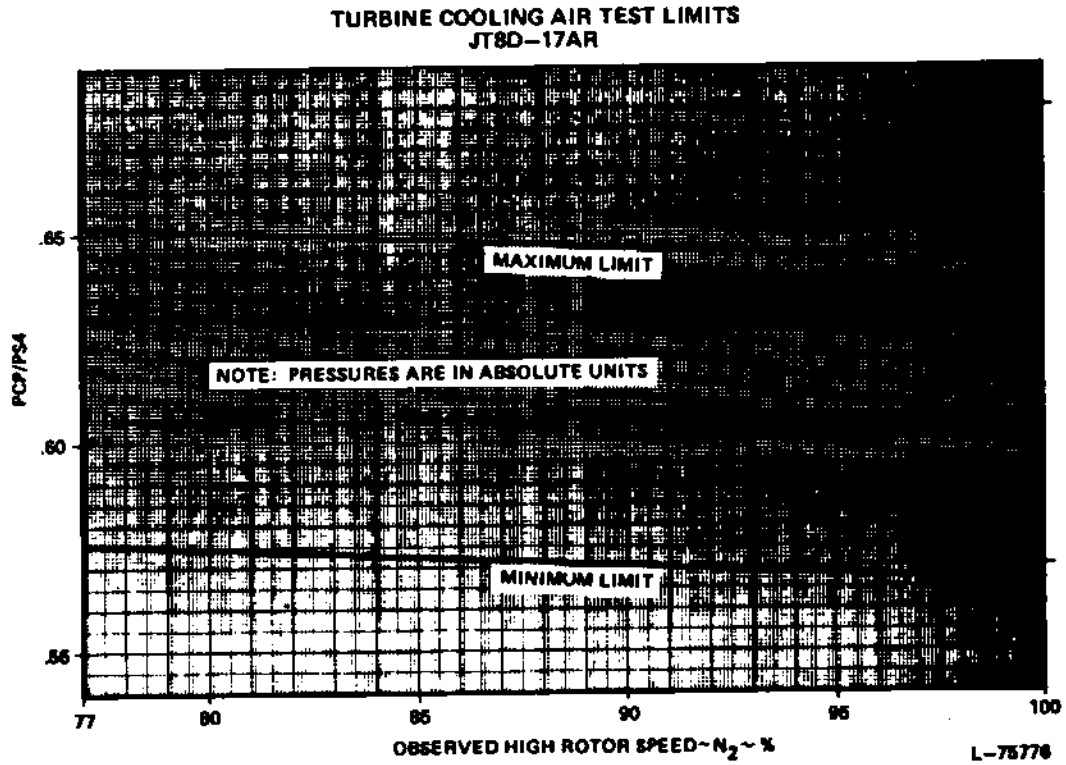
JT8D-17A TURBOFAN
TURBINE COOLING AIR CHECK CURVE



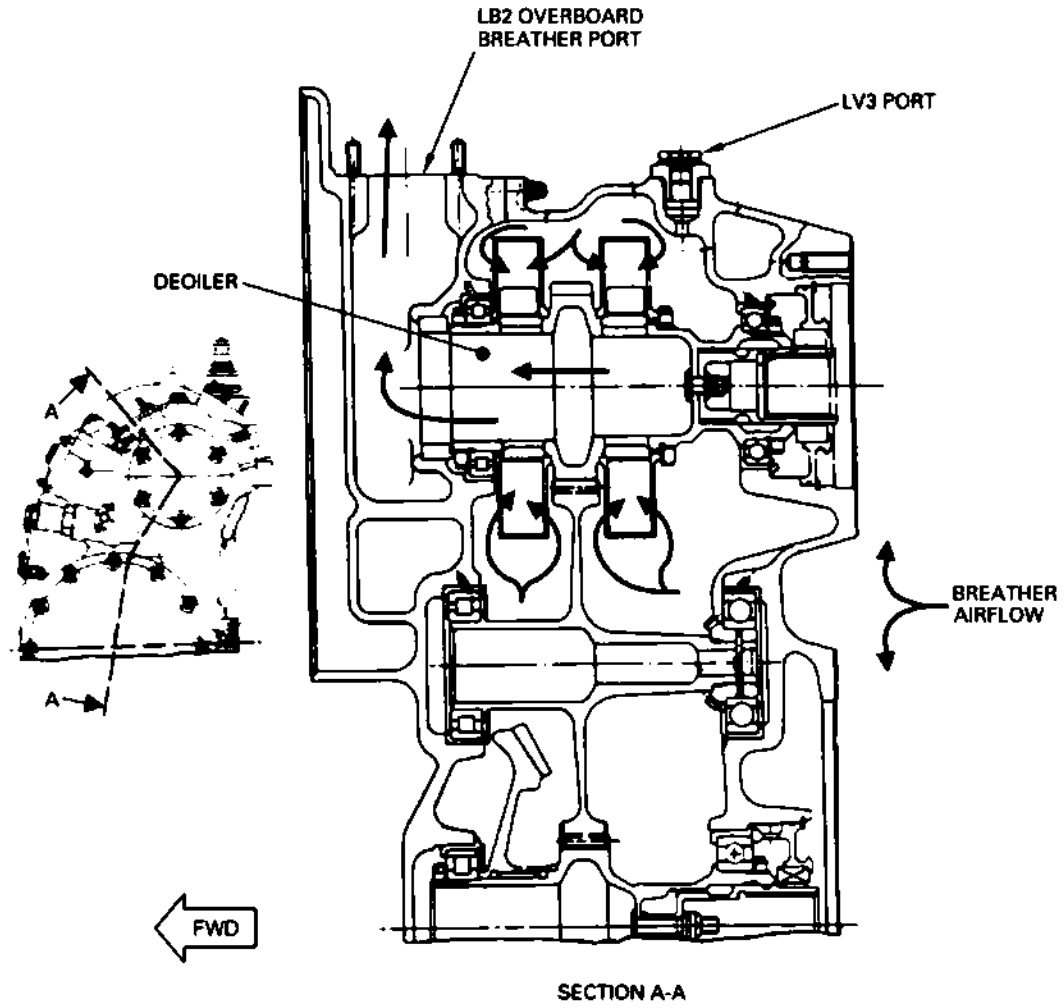
DJ 9-22-82

L-79177

Turbine Cooling Air Test Limits
Figure 513 (Sheet 7)
(Task 72-00-00-760-008)

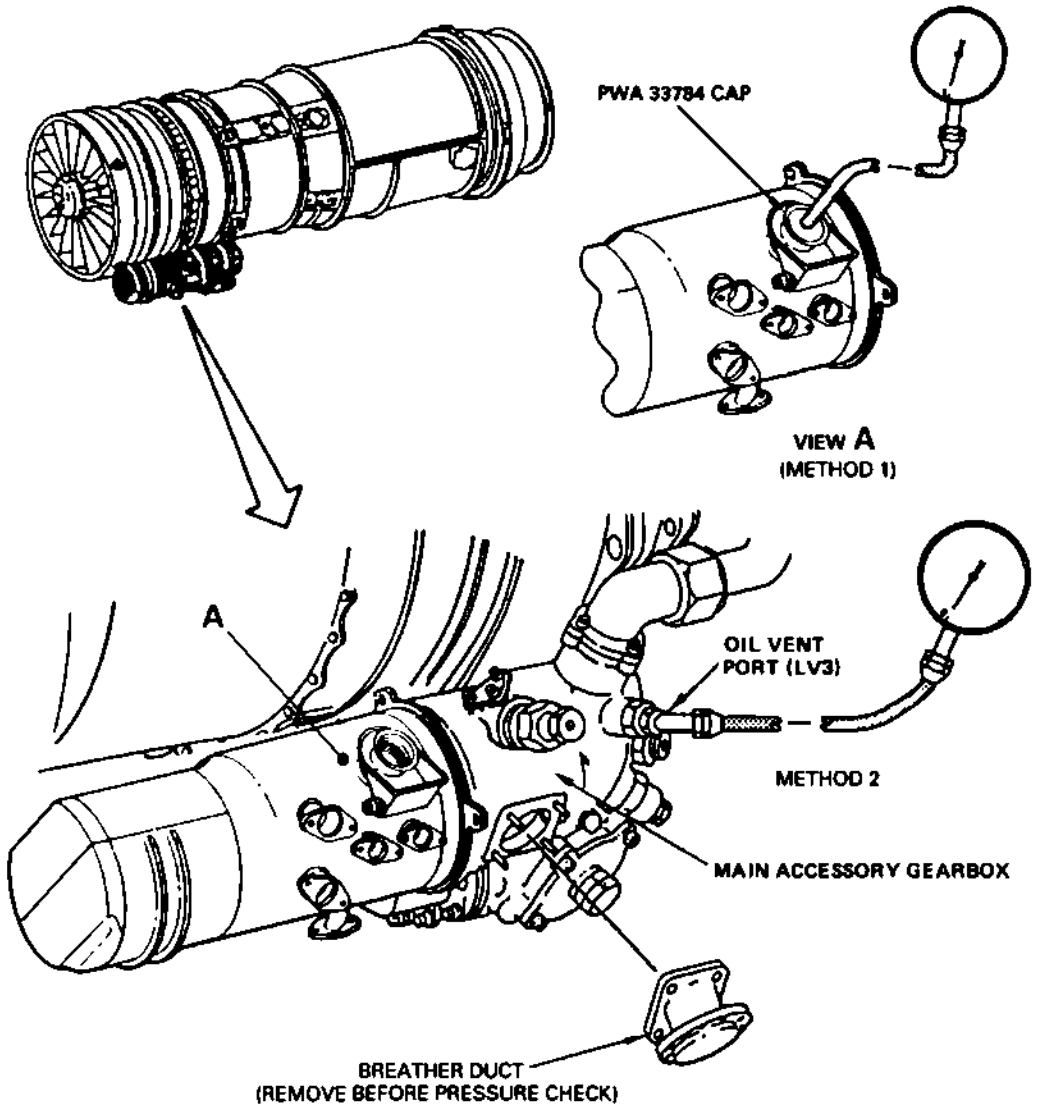


Turbine Cooling Air Test Limits
Figure 513 (Sheet 8)
(Task 72-00-00-760-008)

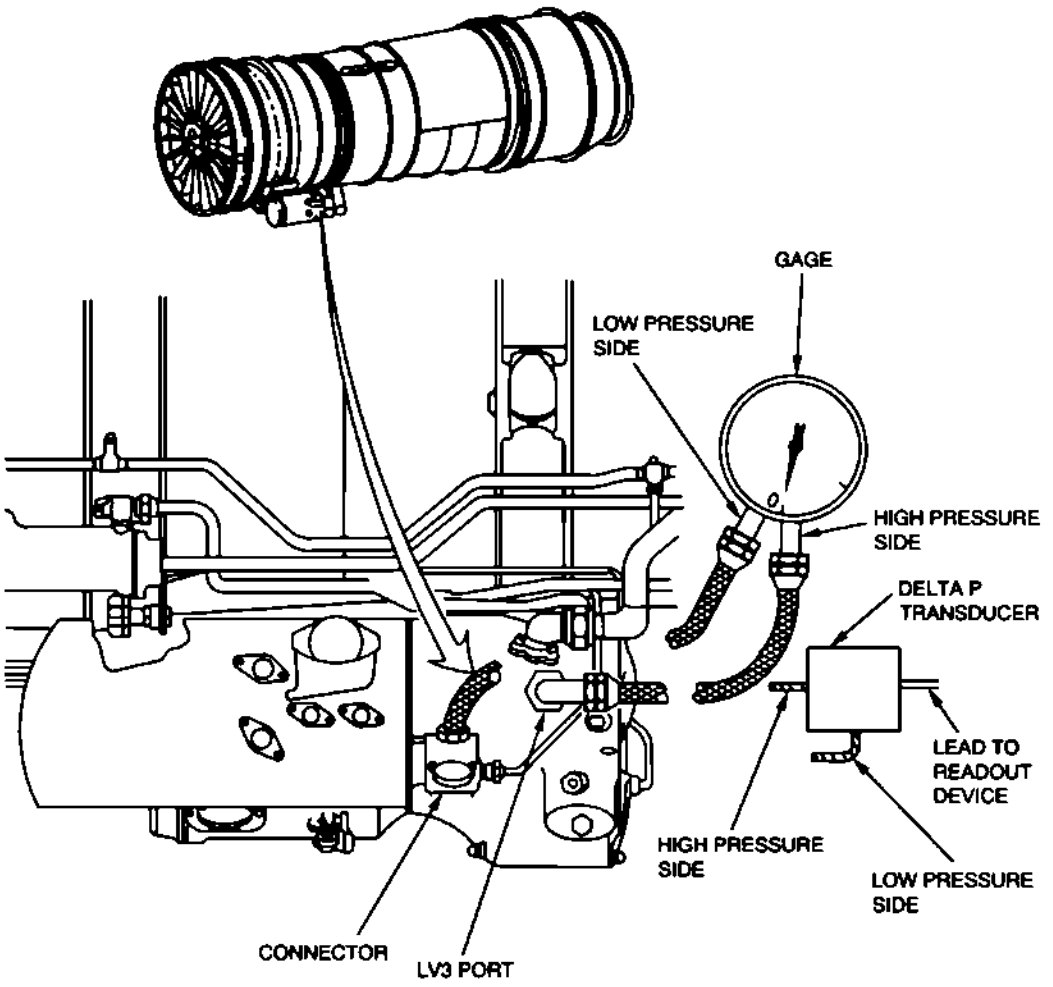


L-H6810 (0705)

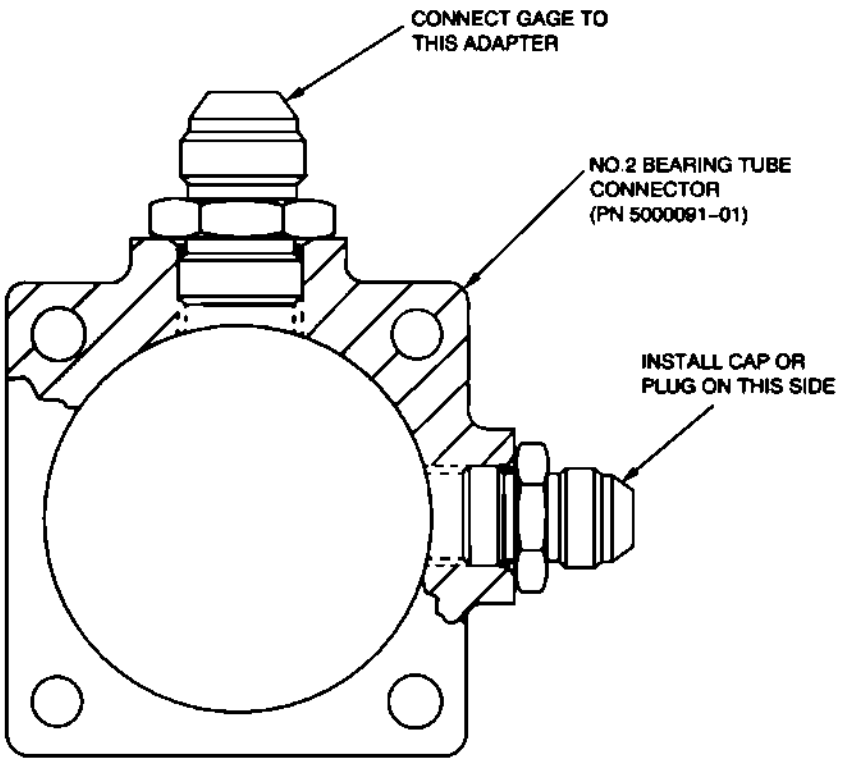
Breather Pressure Flow Diagram
Figure 514
(Task 72-00-00-760-008)



Breather Pressure Instrumentation
Figure 515 (Sheet 1)
(Task 72-00-00-760-008)



Breather Pressure
Instrumentation (Method 3)
Figure 515 (Sheet 2)
(Task 72-00-00-760-008)



L-H6912 (0605)
PW V

Gearbox Port Connector
Figure 515A
(Task 72-00-00-760-008)

INFORMATION	ENGINE POSITION			SOURCE
	1	2	3	
1. Pt7/Pt2 (EPR)	1.65	1.65	1.65	
2. Pt7/P bar	1.647	1.631	1.647	
3. P bar (inches Hg A)				
4. Pt7 (inches Hg A)				(2) X (3) Set power to this value
5. EPR (Cockpit)	1.647	1.635	1.647	Set if (4) not available
6. Pt2/P bar	0.998	0.989	0.998	
7. Pt2 (inches Hg A)				(3) X (6)
8. Ps4 (inches Hg A)				Data
9. Ps4/Pt2				(8) (7)
10. Ps4/Pt2 (Reference)				Latest Overhaul Calibration
11. Δ Ps4/Pt2				(9) - (10)
12. Percent Ps4/Pt2				[(11)/(10)] X 100
13. EGT (°C)				Data
14. Tamb (°F)				Data
15. ΘT2				[(14) + 460] /519 or Figure 505
16. $\sqrt{\Theta T2}$				$\sqrt{\ }$ (15) or Figure 505
17. EGT (°K)				(13) + 273
18. EGT/Θ T2 (°K)				(17)/(15)
19. EGT/Θ T2 (°C)				(18) - 273

L-74791
0689

Engine Ground Check for
Boeing 727 Aircraft
Figure 516 (Sheet 1)
(Task 72-00-00-760-008)

INFORMATION	ENGINE POSITION			SOURCE
	1	2	3	
20. % N2 (Tach.)				Data
21. % N2/$\sqrt{\theta T2}$				(20) / (16)
22. D.P. N2 %				Data Plate
23. % N2/ $\sqrt{\theta T2}$ - D.P. N2				(21) - (22)
24. % N1 (Tach.)				Data
25. % N1/$\sqrt{\theta T2}$				(24) / (16)
26. Ref. N1	82.6	82.6	82.6	
27. % N1/$\sqrt{\theta T2}$ - Ref. N1				(25) - (26)
28. δ T2				(7) / 29.92
29. Fuel Flow Wf pph				Data
29A. Kc				FIGURE 519
30. Wf/(Kc x δ T2)				(29) / [(29A) X (28)]
31. Ref. Wf	5500	5500	5500	
32. Δ (Wf/Kc) δT2				(30) - (31)
33. % Wf/Kc δT2				(32) / (31) X 100

L-74792 (0102)

Engine Ground Check for
Boeing 727 Aircraft
Figure 516 (Sheet 2)
(Task 72-00-00-760-008)

INFORMATION	ENGINE POSITION 1	ENGINE POSITION 2	SOURCE
1. Pt7/Pt2 (EPR)	1.65	1.65	
2. Pt7/P bar	Douglas DC-9 1.648	1.648	
	Sud Caravelle 1.643	1.643	
	Boeing 737 1.645	1.645	
3. P bar (inches Hg A)			
4. Pt7 (inches Hg A)			(2) X (3) Set power to this value
5. EPR (Cockpit)	Douglas DC-9 1.648	1.648	Set if (4) not available
	Sud Caravelle 1.643	1.643	Set if (4) not available
	Boeing 737 1.645	1.645	Set if (4) not available
6. Pt2/P bar	0.999	0.999	
7. Pt2 (inches Hg A)			(3) X (6)
8. Ps4 (inches Hg A)			Data
9. Ps4/Pt2			(8) / (7)
10. Ps4/Pt2 (Reference)			Latest Overhaul Calibration
11. Ps4/Pt2			(9) - (10)
12. Percent Ps4/Pt2			[(11)/(10)] X 100
13. EGT (°C)			Data
14. Tamb (°F)			Data

L-74793 (0000)

Engine Ground Check for
Douglas DC-9, Sud Caravelle,
and Boeing 737 Aircraft
Figure 517 (Sheet 1)
(Task 72-00-00-760-008)

INFORMATION	ENGINE POSITION 1	ENGINE POSITION 2	SOURCE
15. θ T2			[(14) + 460] /519 or Figure 505
16. $\sqrt{\theta T2}$			$\sqrt{(15)}$ or Figure 505
17. EGT (°K)			(13) + 273
18. EGT/ θ T2 (°K)			(17)/(15)
19. EGT/ θ T2 (°C)			(18) - 273
20. % N2 (Tach.)			Data
21. % N2/$\sqrt{\theta T2}$			(20)/(16)
22. D.P. N2 %			Data Plate
23. % N2/$\sqrt{\theta T2}$ - D.P. N2			(21) - (22)
24. % N1 (Tach.)			Data
25. % N1/$\sqrt{\theta T2}$			(24)/(16)
26. Ref. N1	Douglas DC-9 82.6 Sud Caravelle 82.6 Boeing 737 82.0	82.6 82.6 82.0	**or latest overhaul calibration
27. % N1/$\sqrt{\theta T2}$ - Ref. N1			(25) - (26)
28. δ T2			(7)/29.92
29. Fuel Flow Wf pph			Data
29A. Kc			Table XXI
30. Wf/(Kc x δ T2)			(29) / (29A) X (28)

L-74794
0689

Engine Ground Check for
Douglas DC-9, Sud Caravelle,
and Boeing 737 Aircraft
Figure 517 (Sheet 2)
(Task 72-00-00-760-008)

INFORMATION	ENGINE POSITION 1	ENGINE POSITION 2	SOURCE
31. Ref. Wf	Douglas DC-9 5500	5500	
	Sud Caravelle 5500	5500	
	Boeing 737 5450	5450	**or latest overhaul calibration
32. Δ (Wf/Kc) δT2			(30) - (31)
33. % Wf/Kc δT2			[(32)/(31)] X 100

**Reference Values given are from applicable O.I. and are good for all new engines. Overhauled engines should use last calibration.

L-74795
0689

Engine Ground Check for
Douglas DC-9, Sud Caravelle,
and Boeing 737 Aircraft
Figure 517 (Sheet 3)
(Task 72-00-00-760-008)

RELATIVE PRESSURE

DELTA (δ) = $\frac{P}{PO} = \frac{P}{29.92}$ INCHES HGA = PSIA (2.036)

P IN. HG. ABS	δ	P IN. HG. ABS	δ	P IN. HG. ABS	δ	P IN. HG. ABS	δ
40.0	1.337						
39.9	1.334	32.9	1.100	25.9	0.8656	18.9	0.6317
39.8	1.330	32.8	1.096	25.8	0.8623	18.8	0.6283
39.7	1.327	32.7	1.093	25.7	0.8589	18.7	0.6250
39.6	1.324	32.6	1.090	25.6	0.8556	18.6	0.6216
39.5	1.320	32.5	1.086	25.5	0.8523	18.5	0.6183
39.4	1.317	32.4	1.083	25.4	0.8489	18.4	0.6150
39.3	1.313	32.3	1.080	25.3	0.8456	18.3	0.6116
39.2	1.310	32.2	1.076	25.2	0.8422	18.2	0.6083
39.1	1.307	32.1	1.073	25.1	0.8389	18.1	0.6050
39.0	1.303	32.0	1.070	25.0	0.8356	18.0	0.6016
38.9	1.300	31.9	1.066	24.9	0.8322	17.9	0.5983
38.8	1.297	31.8	1.063	24.8	0.8289	17.8	0.5949
38.7	1.293	31.7	1.059	24.7	0.8255	17.7	0.5916
38.6	1.290	31.6	1.056	24.6	0.8222	17.6	0.5882
38.5	1.287	31.5	1.053	24.5	0.8188	17.5	0.5849
38.4	1.283	31.4	1.049	24.4	0.8155	17.4	0.5815
38.3	1.280	31.3	1.046	24.3	0.8122	17.3	0.5782
38.2	1.277	31.2	1.043	24.2	0.8088	17.2	0.5749
38.1	1.273	31.1	1.039	24.1	0.8055	17.1	0.5715
38.0	1.270	31.0	1.036	24.0	0.8021	17.0	0.5682
37.9	1.267	30.9	1.033	23.9	0.7988	16.9	0.5648
37.8	1.263	30.8	1.029	23.8	0.7954	16.8	0.5615
37.7	1.260	30.7	1.026	23.7	0.7921	16.7	0.5581
37.6	1.257	30.6	1.023	23.6	0.7888	16.6	0.5548
37.5	1.253	30.5	1.019	23.5	0.7854	16.5	0.5515
37.4	1.250	30.4	1.016	23.4	0.7821	16.4	0.5481
37.3	1.247	30.3	1.013	23.3	0.7787	16.3	0.5448
37.2	1.243	30.2	1.009	23.2	0.7754	16.2	0.5414
37.1	1.240	30.1	1.006	23.1	0.7720	16.1	0.5381
37.0	1.237	30.0	1.003	23.0	0.7687	16.0	0.5348
36.9	1.233	29.9	0.9993	22.9	0.7654	15.9	0.5314
36.8	1.230	29.8	0.9960	22.8	0.7620	15.8	0.5281
36.7	1.227	29.7	0.9926	22.7	0.7587	15.7	0.5247
36.6	1.223	29.6	0.9893	22.6	0.7553	15.6	0.5214
36.5	1.220	29.5	0.9859	22.5	0.7520	15.5	0.5180
36.4	1.217	29.4	0.9826	22.4	0.7487	15.4	0.5147
36.3	1.213	29.3	0.9793	22.3	0.7453	15.3	0.5114
36.2	1.210	29.2	0.9759	22.2	0.7420	15.2	0.5080
36.1	1.207	29.1	0.9726	22.1	0.7386	15.1	0.5047
36.0	1.203	29.0	0.9692	22.0	0.7353	15.0	0.5013
35.9	1.200	28.9	0.9659	21.9	0.7319	14.9	0.4980
35.8	1.196	28.8	0.9626	21.8	0.7286	14.8	0.4946
35.7	1.193	28.7	0.9592	21.7	0.7253	14.7	0.4913
35.6	1.190	28.6	0.9559	21.6	0.7219	14.6	0.4880
35.5	1.186	28.5	0.9525	21.5	0.7186	14.5	0.4846
35.4	1.183	28.4	0.9492	21.4	0.7152	14.4	0.4813
35.3	1.180	28.3	0.9458	21.3	0.7119	14.3	0.4779
35.2	1.176	28.2	0.9425	21.2	0.7086	14.2	0.4746
35.1	1.173	28.1	0.9392	21.1	0.7052	14.1	0.4713
35.0	1.170	28.0	0.9358	21.0	0.7019	14.0	0.4679
34.9	1.166	27.9	0.9325	20.9	0.6985	13.9	0.4646
34.8	1.163	27.8	0.9291	20.8	0.6952	13.8	0.4612
34.7	1.160	27.7	0.9258	20.7	0.6919	13.7	0.4579
34.6	1.156	27.6	0.9224	20.6	0.6885	13.6	0.4545
34.5	1.153	27.5	0.9191	20.5	0.6852	13.5	0.4512
34.4	1.150	27.4	0.9158	20.4	0.6818	13.4	0.4479
34.3	1.146	27.3	0.9124	20.3	0.6785	13.3	0.4445
34.2	1.143	27.2	0.9091	20.2	0.6751	13.2	0.4412
34.1	1.140	27.1	0.9057	20.1	0.6718	13.1	0.4378
34.0	1.136	27.0	0.9024	20.0	0.6684	13.0	0.4345
33.9	1.133	26.9	0.8990	19.9	0.6651	12.9	0.4311
33.8	1.130	26.8	0.8957	19.8	0.6618	12.8	0.4278
33.7	1.126	26.7	0.8924	19.7	0.6584	12.7	0.4245
33.6	1.123	26.6	0.8890	19.6	0.6551	12.6	0.4211
33.5	1.120	26.5	0.8857	19.5	0.6517	12.5	0.4178
33.4	1.116	26.4	0.8823	19.4	0.6484	12.4	0.4144
33.3	1.113	26.3	0.8790	19.3	0.6450	12.3	0.4111
33.2	1.110	26.2	0.8757	19.2	0.6417	12.2	0.4077
33.1	1.106	26.1	0.8723	19.1	0.6384	12.1	0.4044
33.0	1.103	26.0	0.8690	19.0	0.6350	12.0	0.4011

L-72747

Relative Pressure
Figure 518
(Task 72-00-00-760-008)

TEMPERATURE CORRECTION FOR FUEL FLOW

Tt2 °C	Tt2 °F	Kc	Tt2 °C	Tt2 °F	Kc	Tt2 °C	Tt2 °F	Kc
-40	-40.0	0.8798	-6	21.2	0.9642	28	82.4	1.0286
-39	-38.2	0.8820	-5	23.0	0.9664	29	84.2	1.0308
-38	-36.4	0.8842	-4	24.8	0.9685	30	86.0	1.0329
-37	-34.6	0.8863	-3	26.6	0.9807	31	87.8	1.0351
-36	-32.8	0.8885	-2	28.4	0.9629	32	89.6	1.0373
-35	-31.0	0.8907	-1	30.2	0.9651	33	91.4	1.0395
-34	-29.2	0.8929	0	32.0	0.9673	34	93.2	1.0417
-33	-27.4	0.8951	1	33.8	0.9695	35	95.0	1.0439
-32	-25.6	0.8973	2	35.6	0.9717	36	96.8	1.0461
-31	-23.8	0.8995	3	37.4	0.9739	37	98.6	1.0483
-30	-22.0	0.9017	4	39.2	0.9761	38	100.4	1.0504
-29	-20.2	0.9038	5	41.0	0.9782	39	102.2	1.0526
-28	-18.4	0.9060	6	42.8	0.9804	40	104.0	1.0548
-27	-16.6	0.9082	7	44.6	0.9826	41	105.8	1.0570
-26	-14.8	0.9104	8	46.4	0.9848	42	107.6	1.0592
-25	-13.0	0.9126	9	48.2	0.9870	43	109.4	1.0614
-24	-11.2	0.9148	10	50.0	0.9892	44	111.2	1.0636
-23	- 9.4	0.9170	11	51.8	0.9914	45	113.0	1.0658
-22	- 7.6	0.9192	12	53.6	0.9936	46	114.8	1.0679
-21	- 5.8	0.9214	13	55.4	0.9957	47	116.6	1.0701
-20	- 4.0	0.9235	14	57.2	0.9979	48	118.4	1.0723
-19	- 2.2	0.9257	15	59.0	1.0001	49	120.2	1.0745
-18	- 0.4	0.9279	16	60.8	1.0023	50	122.0	1.0767
-17	1.4	0.9301	17	62.6	1.0045	51	123.8	1.0789
-16	3.2	0.9323	18	64.4	1.0067	52	125.6	1.0811
-15	5.0	0.9345	19	66.2	1.0089	53	127.4	1.0833
-14	6.8	0.9367	20	68.0	1.0111	54	129.2	1.0855
-13	8.6	0.9389	21	69.8	1.0132	55	131.0	1.0876
-12	10.4	0.9410	22	71.6	1.0154	56	132.8	1.0898
-11	12.2	0.9432	23	73.4	1.0176	57	134.6	1.0920
-10	14.0	0.9454	24	75.2	1.0198	58	136.4	1.0942
-9	15.8	0.9476	25	77.0	1.0220	59	138.2	1.0964
-8	17.6	0.9498	26	78.8	1.0242	60	140.0	1.0986
-7	19.4	0.9520	27	80.6	1.0264			

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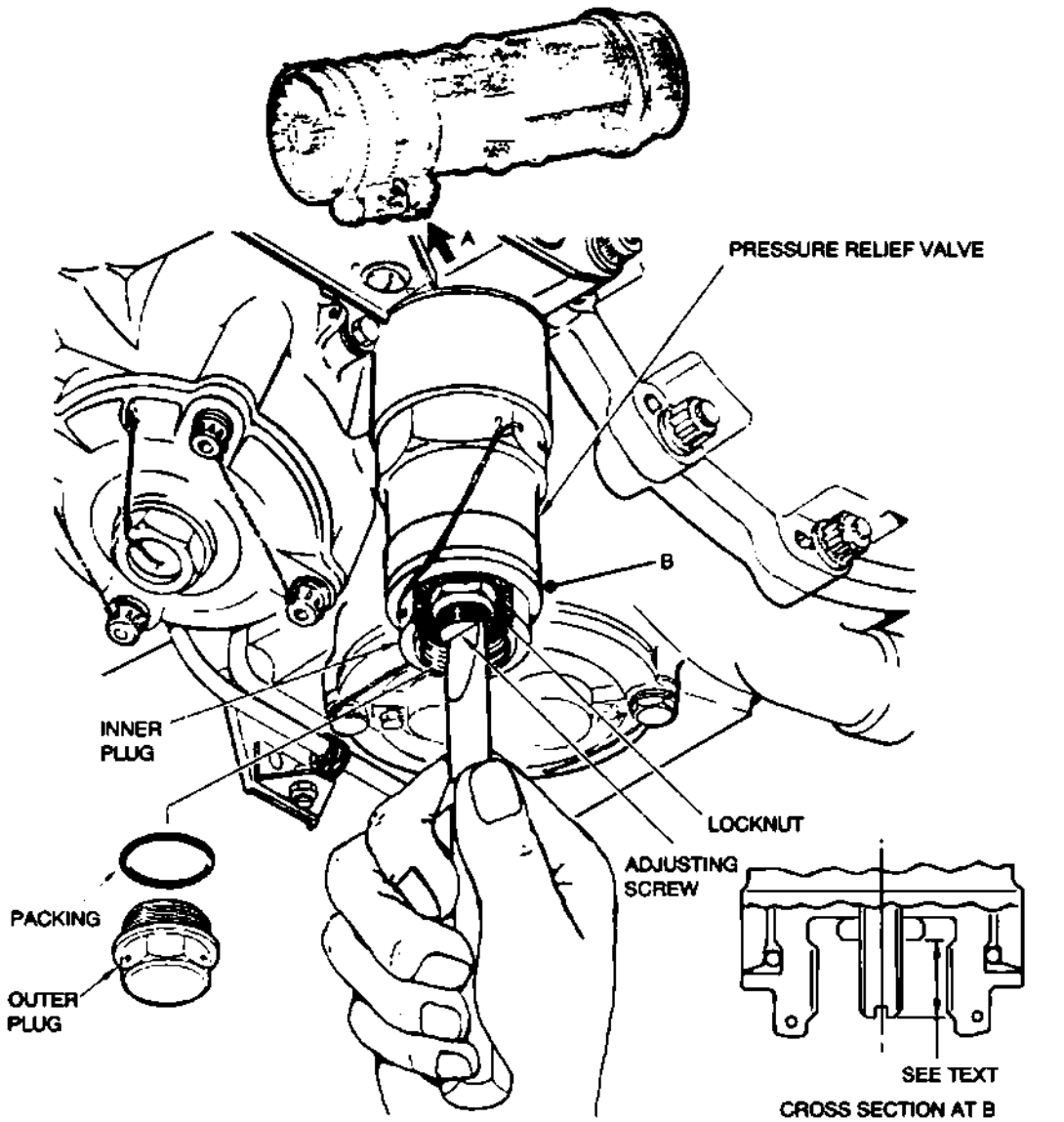
Temperature Correction
For Fuel Flow
Figure 519
(Task 72-00-00-760-008)



Oil Pressure Adjustment
Figure 520
(Task 72-00-00-760-008)

1. Pressure Relief Valve
2. Locknut
3. Adjusting Screw
4. Outer Plug
5. Packing
6. Inner Plug
7. Measure This Thread Protrusion After Oil Pressure Is Adjusted (See Text)

Key to Figure 520

Task 72-00-00-990-031:

1. On Wing Trim Balancing

A. General

CAUTION: THOSE ENGINES WITH EXCESSIVE HIGH ROTOR VIBRATION OR LOW ROTOR VIBRATION WHICH EXCEED LIMITS AS SPECIFIED IN PROCEDURE MAY NOT BE TRIM BALANCED.

(1) Engine whose rotating parts are balanced will normally have some residual unbalance which will result in detectable vibration at engine operating conditions. This vibration may be minimized by trim balancing, which entails addition of weight positioned to offset residual unbalance in compressor front balance plane and compressor middle balance plane.

B. Equipment For Trim Balance

(1) Vibration Pickups: Phased velocity type, CEC 4-123A or equivalent.

(2) Narrow Band Filter: General Radio Model 1564, or Spectral Dynamics, Dynamic Analyzer Tuner SD-101APC, or equivalent. All portions of vibration signal other than low rotor frequency component are filtered out of signal input to phase meter.

(3) Speed and Reference Signal Generator: Sine wave whose frequency is exactly equal to low rotor speed is required as reference signal. Special tachometer and adapter with ratio of 23 to 47 must be mounted in place of any other rotor tachometer or adapter on N1 tachometer pad. Index rotor by aligning single tooth of tachometer with tip of impulse pickup. Small hole in face of tachometer is provided for this purpose. In order to re-index rotor after running without having to make above observation, make mark with layout dye on blade and engine case. Align these marks to re-index case. Electrical conversion of "pip" provided by impulse pickup is accomplished by Spectral Dynamics Corp. Model SD-103 "pip to sine" converter, or equivalent.

Tach. Adapter:	Model B-1692-6, Ratio 23/47 (Exact)
Vendor:	The Electric Tachometer Corp. 68th And Upland Streets Philadelphia, PA 19142
Pulse Generator:	Model HB 163212, one triangular tooth, 1/16 inch flat
Vendor:	HBTool & Engineering Co. 481 Sullivan Avenue South Windsor, CT 06074

(4) Phase Meter: Phase angle between filtered vibration signal and sine wave reference signal is used to determine angular location of residual unbalance. Use phase meter such as Spectral Dynamics Model SD 110, or equivalent.

NOTE: Acton Corp. Model 329B, with A2 plug-in, is acceptable phase meter but is no longer obtainable.

(5) Oscilloscope: Use dual display oscilloscope to monitor two signals of interest to ensure proper setup and operation of equipment.

(6) Frequency Counter: Use frequency counter with 10-second time base to determine low rotor speed to 1 part in 1000.

(7) Vibration Meter-Integrator: This system must accept input signal from vibration pickup mounted on engine. Signal is integrated to convert it from one which is proportional to velocity to one which is proportional to displacement. P&WA Model ED-156-4 vibration meter (Glenn Hathaway Electronics, Canaan, Conn.) or equivalent is required.

C. Setup of Equipment
See Figure 501 (Sheets 1 and 2).

(1) Install vibration pickups (See Task 72-00-00-760-001 Adjustment/Test-01).

(2) Check vibration pickups to ensure that they are in phase (positive outward displacement gives positive voltage output).

(3) Install special tachometer adapter and reference signal generator in place of engine adapter (if any) and N1 tachometer.

(4) With generator in "firing position", reference front compressor (low) rotor to engine case using layout dye.

NOTE: Turn rotor in direction of engine rotation to take up backlash of tachometer drive, that is, clockwise (counterclockwise facing engine fan inlet case).

(5) Manual System: This system is so named because it contains bandpass filter which is manually tuned to low rotor frequency. Typical sequence of operation might be:

(a) Set engine at selected speed point (for example: 600 rpm) and allow engine to stabilize.

(b) With GR1564 in "all pass" position, read overall amplitude.

(c) Switch GR1564 to 1/10 octave position and tune to rotor frequency (for example: 100 cps).

(d) Actuate "phase check" switch. Phase meter should read 270 degrees (± 2 degrees). If phase meter does not read 270 degrees, retune bandpass filter. Release "phase check" switch.

(e) Read IEL amplitude data from vibration meter and phase data from phase meter.

(6) Calibration Of Manual System

(a) System should be calibrated not less than once per week by applying oscillator signal of known amplitude, phase, and frequency to system inputs, (e.g.: simulate both vibration pickup signal and tach signal). With this signal applied, phase meter should read 180 degrees. Amplitude calibration may be accomplished by adjusting frequency and amplitude of signal such that it represents output from vibration pickup at known vibratory condition. Example: Set calibration oscillator at 100 cps and 124 millivolts. With vibration pickup of sensitivity equal to 140 millivolts/inch/sec, this signal would be

equivalent to vibration level of ± 2.0 mils displacement.

Displacement (Mils) =

Millivolt Input X 225.08 (Conversion Constant)/ Frequency (cps) X Pickup Sensitivity (mv/in/sec)

NOTE: Phase meter reads 180 degrees during calibration but 270 degrees during phase check, reference 5(d), because phase lag of 90 degrees is incurred in "pulse to sine converter."

(b) Instrumentation Block Diagram I (Figure 512, Sheet 1) shows manual system.

(7) Automatic System: This system is so named because reference signal is used to tune bandpass filter automatically. Automatic tuning device (tracking filter) will accurately align center frequency of bandpass filter with reference signal. Thus phase lag through filter is constant from one data point to another, and point to point "phase check" required for operation of manual system is not required for automatic system. However, phase check switch should be used periodically (each balance) to validate phase measurement. Typical test sequence might be:

(a) Set selected speed point and allow engine to stabilize.

(b) Actuate phase check switch. Phase meter should read 270 degrees (± 2 degrees). Return switch to normal operating position.

(c) Read phase and amplitude data as outlined in balance program.

(8) Calibration Of Automatic System

(a) Automatic system is calibrated in same manner as manual system, reference preceding step (6).

NOTE: Bandpass filter (SB-101A) incorporates provisions for adjusting phase lag through filter. If adjustment is required for phase calibration, it should be done only after system has been allowed to warm up (about 20 minutes).

(b) Instrumentation Block Diagram II (Figure 512, Sheet 2) shows automatic system.

D. Trim Balance Procedures
See Figures 502 (Sheets 1 and 2).

(1) The following procedure establishes uniform method of approaching trim balance. Data given for phase angle lag and sensitivity are result of experience and may need modification if vibration measuring equipment differ from those used at Pratt & Whitney.

(a) Definition Of Terms

1 1EL - The low speed rotor fundamental vibration amplitude.

2 1EH - The high speed rotor fundamental vibration amplitude.

3 Cw - Calibration weight (serially numbered Cw1, Cw2, etc.) of stainless steel wire used to balance engine. Replaced by equivalent PN balance weight after trim balance.

4 Class - Category into which engine is placed based on prebalance vibration survey. Engines are classified as described in applicable trim balance procedure.

5 Phase Angle - Phase meter reading. Phase angle by which integrated vibration signal lags reference signal.

6 Phase Angle Lag - Calculated angle indicating lag between passing of unbalance weight and response signal. Reference Step (2),(m).

7 Assumed Phase Angle Lag - Weighted average of phase angle lags determined from previous balance attempts. Also, correction angle used in "one-shot" method.

8 VD - Vector difference from Point A to Point C.

9 Peak Vibration - The highest average stable indication after the engine has become stable for 30 seconds and does not include irregular fluctuations which occur momentarily.

(b) Trim Balance Sequence

1 Conduct prebalance vibration survey to determine suitability of engine for trim balance and to provide basis for classification.

2 Run "As Is" speed points for class engine being balanced.

3 From "As Is" data, plot A vector on polar paper, angle being laid out counter to engine rotation from 12 o'clock location. Draw R vector equal and opposite A vector. See Figure 502 (Sheet 1).

4 Apply assumed phase angle lag given for class to which engine has been assigned. Assumed phase angle lag is laid off from R in direction of rotation and indicates angular location of Cw1.

5 Apply assumed sensitivity given in respective trim balance procedures assigned engine class. Multiply amplitude of vector A and sensitivity value to give oz-in. required for Cw1.

6 Install Cw1. May be either stainless steel wire or permanent weight. See Figure 502 (Sheet 2) for computation of wire necessary to correct imbalance. Wire weight is installed on nearest blade to location to that designated by steps outlined in sub-step 4 above.

7 Rerun engine as in step 2 above repeating each speed point within ± 0.2 rev/sec on counter at time base of 10 seconds. Record all data.

8 In conjunction with sub-step 7 above, observe O/A (overall) mils vibration throughout engine speed range to determine if all vibration is within acceptance limits.

9 If engine is acceptable, replace wire trial weight with equivalent weight on balance ring, when applicable. No changes are required if permanent weight was used.

10 If engine is unacceptable, calculate and apply Cw2 as described in specific counterweight installation procedure. All weight runs (Cw1, Cw2...Cwn) are calculated with respect to "As Is" data.

11 Continue to trim balance engine according to applicable Trim Balance Limits And Procedures paragraph.

(c) Complete trim balance report, shown in Figure 502 (Sheet 3) and file report with final engine records.

(2) Hypothetical Example of Vector Balance Method

(a) Assume: Vibration survey has shown need to trim balance (± 2.0 mils at 6000 N1). Engine is classified as "Class X." (Acceptance limit ± 1 mil) Procedure calls for compressor trim at 6000 N1 RPM, assumed phase angle lag of 130 degrees and sensitivity of 1.0 oz-in/mil.

(b) Record inlet pickup phase angle and amplitude at 6000 N1 RPM. In this example let ± 2.0 mil at 300 degrees be the recorded data for run No. 1.

(c) Plot vector A (± 2.0 mil at 300 degrees) on polar paper. Lay out angle counter to engine rotation from 12 o'clock location. Draw vector R equal and opposite vector A. (See plot on Figure 502 (Sheet 1).

(d) Apply assumed phase angle lag (130 degrees) laying it off from R in direction of rotation. This indicates that Cw1 should be applied at 350 degrees as measured from 12 o'clock reference location counter to engine rotation.

(e) Apply assumed sensitivity. Multiply amplitude of A vector (± 2.0 mil) by assumed sensitivity (1.0 oz-in/mil). Magnitude of Cw1 should be 2 oz-in.

(f) Install Cw1. Wire weight may be installed on nearest blade to 350 degrees. In this example let blade No. 2, shown on plot, be chosen (348 degrees).

(g) Rerun balance point and record phase angle and amplitude resulting from addition of Cw1. Run No. 2.

(h) In conjunction with previous step (7), observe O/A mils throughout engine speed range to determine if all vibration is within acceptance limits.

(i) Let data from Run No. 2 be ± 1.3 mils at 20 degrees. Plot data as vector C on polar paper. Lay out angle counter to engine rotation from 12 o'clock location.

(j) Plot vector difference (VD) by subtracting vector A from vector C. Draw VD from A to C, arrow pointing to C. Translate VD vector to origin of diagram. In this example VD is ± 2.2 mils at 84 degrees. VD represents effect of CW1 alone, both in magnitude and direction. To eliminate unbalance (A vector), VD must be rotated and adjusted in length to coincide with R vector.

(k) Calculate location and size of required balance weight, Cw2.

1 Size of correction weight = size of trial weight
X A mils/VD mils

$$Cw2 = 2 \times \frac{2}{2.2} = 1.82 \text{ oz-in.}$$

2 Location of correction weight: In this example, angular amount between VD (84 degrees) and R (120 degrees) is 36 degrees counter to engine rotation. Remove Cw1, move from its location 36 degrees counter to engine rotation to 24 degrees. Apply Cw2 (1.82 oz-in.) at 24 degrees (blade No. 29). This should cause VD to coincide with R.

(l) Above procedure can be repeated using second correction weight as new calibration weight. Data from new weight and "As Is" data can be used to calculate third correction weight and thereby refine balance.

(m) Determine phase angle lag and vibration sensitivity. (Although not required for any specific engine balance, average values calculated from several engine balances are considered valuable guide for follow-on balance jobs).

1 Phase Angle Lag: Unbalance vectors are measured in terms of amplitude and phase angle (phase meter reading) and are plotted referenced to 12 o'clock location in direction counter to rotation to indicate "lag". Normal plotting procedure locates reference point at top of engine vertical centerline designated as 12 o'clock. This point is shown on the plot as 0 degrees. Balance weights are located on rotor after rotor has been turned (indexed) to locate pulse generator tooth directly under pulse pickup. Angular location of the weight is then measured in direction counter to rotation referenced to 12 o'clock. To determine phase angle lag, unbalance vectors and weight locations must be given common frame of reference. Angular location corresponding to 12 o'clock is taken as common reference point. Phase angle lag is angle by which response (VD) lags calibration weight. Graphically, it is angle from calibration weight to VD measured counter to engine rotation. In this example, phase lag is 96 degrees.

2 Sensitivity: Sensitivity can be calculated at any given speed point by dividing weight amplitude (Cw1 = 2.0 oz-in.) by measured response (VD = 2.2 mils). In this example calculated sensitivity is 0.91 oz-in. per mil.

(n) The purpose of calculating phase angle lag and sensitivity is to provide information to assist in future balances. Weighted average of these data from number of balances provide assumed phase angle lag and assumed sensitivity which, when applied to "As Is" data, establish "one

shot" balance method. In this example let assumed phase angle lag equal 96 degrees. After plotting information described in Step (2)(a), the 96 degree angle is now laid out from R vector in direction of engine rotation and establishes Cw1 location. Amount of weight required is established by multiplying A vector amplitude (± mils) by sensitivity (oz-in/mil) which, for this example, gives 1.82 oz-in. required. It can now be seen that engine would be balanced by this Cw1 and no further runs are necessary.

E. On Wing Trim Balance Limits And Procedures For JT8D-1,-1A,-1B,-7,-7A,-7B,-9,-9A,-11

(1) Trim Balance Limits

(a) Engines that experience vibration at N1 rotational frequency at inlet case and/or exhaust duct up to and including tabulated trim balance amplitudes Table 501, may be trim balanced to bring them within acceptance limits. During the running for trim balancing, vibration amplitudes of N1 frequency up to 0.0041 inch (single amplitude) below 5200 rpm N1 and 0.0035 inch (single amplitude) at 5200 rpm N1 and above are allowable.

Pickup	Trim Balance Amplitudes (Single Amplitude)	(N1 Rotational Frequency Limits) (Double Amplitude)
Inlet Case (except as noted)	0.0030 inch (3 mils)	0.0060 inch (6 mils)
Inlet Case (3900-5199 rpm, inclusive)	0.0040 inch (4 mils)	0.0080 inch (8 mils)
Exhaust Section (Rear Mount)	0.0025 inch (2.5 mils)	0.0050 inch (5 mils)

Trim Balance Vibration Limits
(JT8D-1,-1A,-1B,-7,-7A,-7B,-9,-9A,-11)
Table 501

(b) Front compressor front plane trim balance weight limits.

1 For JT8D-1,-1A,-1B,-7,-7A,-7B,-9,-9A engines not incorporating SB 1815, the maximum correction (all trim weights) for trim balancing front compressor at front plane shall not exceed a total vector sum of 5.0 oz-in. The prior installed weights used for balancing the compressor rotor assembly on balance machine may be moved or replaced, but total number of weights used on final rotor assembly shall not exceed four and total vector sum shall not exceed 8.0 oz-in.

2 For JT8D-1,-1A,-1B,-7,-7A,-7B,-9,-9A engines incorporating SB 1815, and JT8D-11 engines, the maximum correction (all trim weights) for trim balancing front compressor at front plane shall not exceed a total vector sum of 5.0 oz-in. The total number of trim weights used on the outer diameter balancing ring of the final rotor assembly shall not exceed two.

3 For JT8D-1,-1A,-1B,-7,-7A,-7B,-9,-9A,-11 engines incorporating SB 5517, the maximum correction (all trim weights) for trim balancing front compressor at front plane shall not exceed a total vector sum of 5.0 oz-in. The prior installed weights used for balancing the compressor rotor assembly on balance machine may be moved or replaced, but total number of weights used on final rotor assembly shall not exceed four and total vector sum shall not exceed 9.0 oz-in.

(c) Front compressor mid-plane trim balance limits (JT8D-1,-1A,-1B,-7,-7A,-7B,-9,-9A,-11 engines incorporating SB 2599)

1 Remove engine parts to provide access to interior of front compressor rotor as follows:

a Remove front accessory drive group. See Section 72-21-00, Removal/Installation-00.

b Remove retaining ring holding front accessory drive gearshaft in front hub. Engage PWA 12292 Puller behind gearteeth and remove gearshaft with careful knocker action.

c Using PWA 12402 Wrench, remove plug from bore of front hub.

2 The maximum correction (all trim weights) for trim balancing the front compressor at the mid-plane (3rd - 4th stage spacer) shall not exceed a total vector sum of 5 oz-in. The total number of trim weights used at this plane shall not exceed two weights per tube at a maximum of five locations within 120 degrees. Maximum correction (all trim weights) for trim balancing the front compressor at both the front plane and mid-plane shall not exceed a total vector sum of 5 oz-in. Any weights that were installed during static balance of the 3rd - 4th stage spacer may be shifted during trim balance, if necessary, using PWA 33437 Remover and PWA 33436 Inserter. See Figure 503.

NOTE: Insert PWA 33437 Remover in rotor and hook lip of end plate under flange of counterweight. Twist remover to spring counterweight off spacer tube. Apply tape to end plate of remover and extract loose counterweight.

3 Reinstall parts removed for access as follows:

a Install front compressor rotor plug, with new packing coated with PWA 36500 Assembly Fluid, in front hub. Handtighten the plug with PWA 12402 Wrench.

b Install front accessory drive gearshaft in front hub and secure with retaining ring.

c Install front accessory drive group. See Section 72-21-00, Removal/Installation-00.

(d) Front compressor drive turbine trim balance weight limits.

1. Maximum correction (all trim weights) for trim balancing front compressor drive turbine at rear plane shall not exceed total vector sum of 2.5 oz-in. Previously installed weights used for balancing turbine rotor assembly may be moved or replaced, but total number of weights used on final rotor assembly shall not exceed four and total vector sum shall not exceed 6.5 oz-in. Use PWA 32572 Riveter for turbine area counterweights. See Figure 503 and Table 505.

(e) Conduct vibration survey to vibration limits in Adjustment/Test, with calibration weights installed. Vibration levels shall not exceed those given in Step (1).

(f) After completing installation of final trim balance weights, conduct a vibration survey and vibration levels should meet acceptance limits. A second vibration survey shall be made to demonstrate repeatability. Variations between runs shall not exceed 0.0006 inch (single amplitude) for the highest vibration peak between 3900 and 5200 rpm N1 and 0.0003 inch (single amplitude) at take-off.

(g) JT8D trim balance report must be completed and filed with the final engine records. See Figure 504 (Sheet 3) for sample trim balance report.

(2) Trim Balance Procedure

(a) Using PWA 32500 Riveter install trim balance weights on outer ring of first stage compressor blade positioning plate. See Figure 504 and Tables 502, 503 and 504.

NOTE: On engines so equipped, install balance weights on single inner ring of positioning plate.

NOTE: On assembly prior to SB 5517 (incorporating dual counterweight rings), PN 794247 counterweight may be used on outer ring in place of counterweights specified in Index 1 of Figure 516.

NOTE: Engines with respaced inlet (post SB 5948, 5849, 5850), use PWA 46439 Riveter to attach the balance weights.

Balance Correction For Engines With Dual Ring Positioning Plate

Blade Retaining Plate Radius = PN 577618, 639611: 6.755 Inch
PN 771868: 6.845 Inch

Part Number	wt. (oz.)	Balance Corr. (oz-in.)
627067	.7035	5.0
627068	.399	3.0
627069	.100	1.0

Classification Data Engines With Single Inner Ring Positioning Plate

Radius = PN 525838: 5.15 Inches

av. Class	wt. (oz)	moment (oz-in)	av. Class	wt. (oz)	moment (oz-in)	av. Class	wt. (oz)	moment (oz-in)
				PN 528129				
1	.101	.640	11	.339	1.84	21	.582	3.04
2	.125	.760	12	.361	1.96	22	.606	3.16
3	.149	.882	13	.386	2.08	23	.631	3.28
4	.172	1.00	14	.410	2.20	24	.656	3.40
5	.195	1.12	15	.435	2.32	25	.680	3.52
6	.217	1.24	16	.460	2.44	26	.705	3.64
7	.242	1.36	17	.485	2.56	27	.727	3.76
8	.286	1.48	18	.509	2.68	28	.752	3.88
9	.291	1.50	19	.534	2.80	29	.777	4.00
10	.320	1.72	20	.557	2.92			
				PN 528128				
			1	.033	.160			
			2	.057	.280			
			3	.081	.400			
			4	.105	.520			

Installation Rivet PN 530387. Moment includes rivet weight and c.g. change with height of weight.

No. 1 Hub Balance Weights For JT8D-1,-1A,-1B,-7,-7A,-7B Engines
Table 502

Balance Correction For Engines With Dual Ring Positioning Plate

Blade Retaining Plate Radius = PN 616645, 639616: 6.050 Inch
PN 760297: 6.125 Inch

Part Number	wt. (oz.)	Balance Corr. (oz-in.)
616646	.814	5.0
627070	.4535	3.0
627071	.1415	1.0

Classification Data Engines With Single Inner Ring Positioning Plate

Radius = PN 520451: 4.305 Inch

av. Class	wt. (oz)	moment (oz-in)	av. Class	wt. (oz)	moment (oz-in)	av. Class	wt. (oz)	moment (oz-in)
			PN 583176					
1	.102	.54	14	.410	1.84	27	.727	3.14
2	.125	.64	15	.435	1.94	28	.752	3.24
3	.149	.74	16	.460	2.04	29	.777	3.34
4	.172	.84	17	.485	2.14	30	.803	3.44
5	.195	.94	18	.509	2.24	31	.827	3.54
6	.217	1.04	19	.534	2.34	32	.852	3.64
7	.242	1.14	20	.557	2.44	33	.877	3.74
8	.286	1.24	21	.582	2.54	34	.903	3.84
9	.291	1.34	22	.606	2.64	35	.926	3.94
10	.320	1.44	23	.631	2.74	36	.951	4.04
11	.339	1.54	24	.656	2.84	37	.976	4.14
12	.361	1.64	25	.680	2.94	38	1.00	4.24
13	.386	1.74	26	.705	3.04	39	1.03	4.34
			PN 528128					
			1	.033	.14			
			2	.057	.24			
			3	.081	.34			
			4	.105	.44			

Installation Rivet PN 530387. Moment includes rivet weight and c.g. change with height of weight.

No.1 Hub Balance Weight For
JT8D-9 thru -17AR Engines
Table 503

Balance Correction For Engines With Single Outer Ring Retaining Plate

Blade Retaining Plate Radius = PN 793935, 802710: 6.125 Inch
PN 793937: 6.845 Inch
PN 803996, 808145: 6.115 Inch

Part Number	wt. (oz.)	
794247 CL1	0.133	
794247 CL2	0.193	
794247 CL3	0.330	
794247 CL4	0.416	
794247 CL5	0.500	
528128 CL1	.033	.20
528128 CL2	.057	.35
528128 CL3	.081	.50
528128 CL4	.105	.64
803915 CL1	.033	.20
803915 CL2	.057	.35
803915 CL3	.081	.50
803915 CL4	.105	.64

Installation Rivet PN 530387 for PN 794247 counterweight; use PN 530387 rivet with PN 803996 and prior retaining plate. Use PN 803914 rivet with PN 808145 retaining plate. Moment includes rivet weight and c.g. change with height of weight.

No. 1 Hub Balance Weight For
JT8D-9 thru -17AR Engines
Table 504

Radius = 6.15 Inches

Class	av. wt. (oz)	moment (oz-in)	Class	av. wt. (oz)	moment (oz-in)
		PN 528788			
1	.056	.35	10	.204	1.26
2	.073	.45	11	.220	1.36
3	.089	.55	12	.237	1.46

Turbine Hub Balance Weights
Classification Data For
JT8D-1,-1A,-1B,-7,-7A,-7B,-9,
-9A,-11 Engines
Table 505

Radius = 6.15 Inches

Class	av. wt. (oz)	moment (oz-in)	Class	av. wt. (oz)	moment (oz-in)
		PN 528788			
(CONTINUED)					
4	.106	.65	13	.253	1.56
5	.122	.75	14	.270	1.66
6	.138	.85	15	.286	1.76
7	.155	.95	16	.303	1.86
8	.171	1.05	17	.320	1.96
9	.188	1.15	18	.336	2.07

PN 528789

Class	av. wt. (oz)	moment (oz-in)
1	.016	.10
2	.032	.20
3	.049	.30
4	.065	.40

Installation Rivet PN 528130. Moment includes rivet weight and c.g. change with height of weight.

Turbine Hub Balance Weights
Classification Data For
JT8D-1,-1A,-1B,-7,-7A,-7B,-9,
-9A,-11 Engines
Table 505 (Continued)

(b) Remove access plate on exhaust fairing and using PWA 32572 Riveter install required trim balance weights to fourth stage turbine disk. See Figure 504 and Table 505.

(c) Re-assemble all parts removed.

NOTE: If exhaust fairing does not incorporate an access plate refer to SB 2030 or SB 5253.

(d) Classification Instructions and Procedure. See Figure 517. Engines are given different classifications based on vibration amplitude versus speed plot. The classification segregates engines so that most expeditious balance procedure

can be used. Those engine speeds given in this section are that of the low rotor and are intended to convey the idea of a vibration peak near the prescribed speed. Slight speed variations of the exact "peak" at which the vibration occurs are to be expected. The acceptance limit means the O/A (overall) vibration meter reading (40 cps filter). The low rotor component is noted by 1EL. Search out and adjust the engine rpm to the peak vibration for all speed points given in the procedure except take-off (T.O.) where the engine is set per applicable part power setting curve.

1 Class I for JT8D-1,-1A,-1B,-7,-7A,-7B,-9,-9A

Symptom: a Inlet pickup ± 2.0 mils O/A or greater at 5000 N1.

and b Inlet pickup over acceptance limits at 4200 N1, 6000 N1, or Take-Off.

Classification: Classify as Class 1 if either -

a Inlet pickup over acceptance limits at 4200 N1. The 6000 N1 and/or Take-Off points greater than ± 1.0 mils 1EL.

or b Inlet pickup over acceptance limits at 6000 N1 or Take-Off.

and c In either case the 5000 N1 points is ± 2 mils O/A or greater.

Procedure: Compressor trim. Use inlet pickup. Record "As Is" amplitude and phase angle at T.O. (8000 N1) only. Log O/A amplitude at 4200 N1, 5000 N1, and 6000 N1. Use assumed phase angle lag of 12 degrees and assumed sensitivity of 2.4 oz-in/mil for engines with both No. 1 and 6 bearings non-oil damped. For engines with both No. 1 and 6 or 1, 5 and 6

(CONTINUED)

bearings oil damped, use assumed phase angle lag of 161 degrees (149 degrees for JT8D-9,-9A) and assumed sensitivity of 3.15 oz-in/mil (3.92 oz-in/mil for JT8D-9,-9A).

Continue with trim balance sequence until 6000 N1 and T.O. points are acceptable.

If 4200 N1 and 5000 N1 points persist, proceed to Class 3 or Class 4.

2 Class 1 For JT8D-11

Symptom: a Inlet pickup ± 2.0 mils O/A or greater at 5100 N1.

and b Inlet pickup over acceptance limits at 4200 N1, 6000 N1, or Take-Off.

Classification: Classify as Class 1 if either -

a Inlet pickup over acceptance limits at 4200 N1. The 6000 N1 and/or Take-Off points greater than ± 1.0 mils 1EL.

or b Inlet pickup over acceptance limits at 6000 N1 or Take-Off.

and c In either case the 5000 N1 points is ± 2 mils O/A or greater.

Procedure: Compressor trim. Use inlet pickup. Record "As Is" amplitude and phase angle at Take-Off (approx. 8000 N1) only. Log O/A amplitude at 4200 N1, 5000 N1, and 6000 N1. Use assumed phase angle lag of 125 degrees and assumed

(CONTINUED)

sensitivity of 2.4 oz-in./mil for engines with both No. 1 and 6 bearings non-oil damped. For engines with both No. 1 and 6 or No. 1, 5 and 6 bearings oil damped use assumed phase angle lag of 160 degrees and assumed sensitivity of 4.07 oz-in./mil.

Continue with trim balance sequence until 6000 N1 and T.O. points are acceptable.

If 4200 N1 and 5100 N1 points persist, proceed to Class 3 or Class 4.

3 Class 2 For
JT8D-1,-1A,-1B,-7,-7A,-7B,-9,-9A,-11

Symptom: Inlet pickup over acceptance limits at 4200 N1, 6000 N1 or T.O. The 5000 (5100 for JT8D-11) N1 point is less than ± 2 mils O/A.

Classification: Classify as Class 2 if either -

a 4200 N1 over acceptance limits. The 6000 N1 and/or T.O. points are greater than ± 1.0 mils 1EL.

or b 6000 N1 and/or T.O. points over acceptance limits.

and c In either case the 5000 (5100 for JT8D-11) N1 point is less than ± 2 mils O/A.

Procedure: Compressor trim. Use inlet pickup. Record "As Is" amplitude and phase angle at T.O. (8000 N1) only. Log O/A amplitude at 4200 N1, 5000 (5100 for JT8D-11) N1, and 6000 N1.

(CONTINUED)

Use assumed phase angle lag of 125 degrees and assumed sensitivity of 2.4 oz-in./mil.

Continue with trim balance sequence until 4200 N1, 6000 N1 and T.O. points are acceptable.

4 Class 3 For JT8D-1,-1A,-1B,-7,-7A,-7B,-9,-9A

Symptom: Inlet over acceptance limits at 5000 N1.

Classification: Classify as Class 3 those engines that are over acceptance limits at 5000 N1, within limits at 4200 N1 and less than ± 1.0 mils 1EL at 6000 N1 and T/O.

Procedure: Turbine balance. Use inlet pickup. Record "As Is" amplitude and phase angle at the 5000 (5100 For JT8D-9,-9A) N1 peak and at two points at lower speed on the rising amplitude curve of the 5000 (5100 For JT8D-9,-9A) N1 peak, but higher in speed than any peak occurring at 4200 N1. Use assumed phase angle lag of 20 degrees and assumed sensitivity of 0.8 oz-in./mil (0.503 in./mil for the 5000 (5100 For JT8D-9,-9A) N1 point. If Cw1 does not sufficiently reduce the 5000 (5100 For JT8D-9,-9A) N1 point, calculate Cw2 from the two other speed points. Preference may be given to the results of the lower speed point of the two if conflict in amount of weight and placement occurs.

5 Class 3 For JT8D-11

Symptom: Inlet over acceptance limits at 5100 N1.

Classification: Classify as Class 3 those engines that are over acceptance limits at 5100 N1 within limits at 4200 N1 and less than ± 1.0 mils 1EL at 6000 N1 and Take-Off.

Procedure: Turbine balance. Use inlet pickup. Record "As Is" amplitude and phase angle at the 5100 N1 peak. Use assumed phase angle lag of 30 degrees and assumed sensitivity of 0.5 oz-in./ mil for 5100 N1 point. If Cw1 does not sufficiently reduce 5100 N1 point, calculate Cw2 from two other speed points. Preference may be given to results of lower speed point of two if conflict in amount of weight and placement occurs.

6 Class 4 For
JT8D-1,-1A,-1B,-7,-7A,-7B,-9,-9A,-11

Symptom: Inlet over acceptance limits at 4200 N1 and/or 5000 (5100 for JT8D-9,-9A,-11) N1 points only.

Classification: Classify as Class 4 those engines which have the twin peaks, at least one of which is over limits, and have less than ± 1.0 mils 1EL at the 6000 N1 and T.O. points.

Procedure: Same as Class 3.

7 Class 5 For
JT8D-1,-1A,-1B,-7,-7A,-7B,-9,-9A,-11

Symptom: Rear pickup acceptance limits.

Classification: Classify as Class 5 those engines which have an over limit condition between 6000 - 7000 N1 speed on the rear pickup.

Procedure: No balance. Reject engine if inlet pickup amplitude is low and has no peak values. Have teardown inspect balance and runout at the 4 1/2 bearing area.

Low compressor trim balance may be attempted if inlet pickup vibration is greater than 1.0 mil single amplitude at a peak value, providing rear pickup vibration peak does not exceed 0.5 mils over acceptance limit for rear pickup.

NOTE: See "Hypothetical Example of Vector Balance Method."

F. On Wing Trim Balance Limits and Procedures For JT8D-15,-15A,-17,-17A,-17R,-17AR

(1) Trim Balance Limits

(a) Engines that experience vibration at N1 rotational frequency at inlet case and/or exhaust duct up to and including tabulated trim balance amplitudes (Table 506) may be trim balanced to bring them within acceptable limits. (See Tables 516 and 517). During the running for trim balancing, vibration amplitudes of N1 frequency up to .004 inch (single amplitude) are allowable.

Trim Balance Amplitudes
Overall Vibration

Pickup	(Single Amplitude)	(Double Amplitude)
Inlet Case	0.0030 inch (3 mils)	0.0060 inch (6 mils)
Exhaust Section (Rear Mount)	0.0025 inch (2.5 mils)	0.0050 inch (5 mils)

Trim Balance Vibration Limits
(JT8D-15,-15A,-17,-17A,
-17R,-17AR)
Table 506

(b) Front compressor front plane trim balance weight limits.

1 Prior to SB 5517: The maximum correction (all trim weights) for trim balancing front compressor at front plane shall not exceed a total vector sum of 5.0 oz-in. The total number of trim weights used on the outer diameter balancing ring of the final rotor assembly shall not exceed two.

2 Incorporating SB 5517: The maximum correction (all trim weights) for trim balancing front compressor at front plane shall not exceed a total vector sum of 5.0 oz-in. The prior installed weights used for balancing the compressor rotor assembly on balance machine may be moved or replaced, but total number of weights used on final rotor assembly shall not exceed four and total vector sum shall not exceed 9.0 oz-in.

(c) Front compressor mid-plane trim balance limits (engines incorporating snap-on counterweights on 3rd-to-4th stage compressor spacer).

1 Remove engine parts to provide access to interior of front compressor rotor as follows:

a Remove front accessory drive group. See Section 72-21-00, Removal/Installation-00.

b Remove retaining ring holding front accessory drive gearshaft in front hub. Engage PWA 12292 Puller behind gearteeth and remove gearshaft with careful knocker action.

c Using PWA 12402 Wrench, remove plug from bore of front hub.

2 The maximum correction (all trim weights) for trim balancing the front compressor at the mid-plane (3rd - 4th stage spacer) shall not exceed a total vector sum of 5.0 oz-in. The total number of trim weights used at this plane shall not exceed two weights per tube at a maximum of five locations within 120 degrees. The maximum correction (all trim weights) for trim balancing the front compressor at both the front plane and the mid-plane shall not exceed a total vector sum of 5.0 oz-in. Any weights that were installed during static balance of the 3rd - 4th stage spacer may be shifted during trim balance, if necessary, using PWA 33537 Remover and PWA 33436 Inserter. See Figure 503.

NOTE: Insert PWA 33437 Remover in rotor and hook lip of end plate under flange of counterweight. Twist remover to spring counterweight off spacer tube. Apply tape to end plate of remover and extract loose counterweight.

3 Reinstall parts removed for access as follows:

a Install front compressor rotor plug, with new packing, coated with PWA 36500 Assembly Fluid, in the front hub. Handtighten plug with PWA 12402 Wrench.

b Install front accessory drive gearshaft in front hub and secure with retaining ring.

c Install front accessory drive group. See Section 72-21-00, Removal/Installation-00.

(d) Front compressor drive turbine trim balance weight limits.

1. The maximum correction (all trim weights) for trim balancing front compressor drive turbine at rear plane shall not exceed total vector sum of 2.5 oz-in. The prior installed weights used for balancing turbine rotor assembly on balance machine may be moved or replaced, but total number of weights used on final rotor assembly shall not exceed four and total vector sum shall not exceed 6.5 oz-in.

   NOTE: Lowest possible levels of vibration are desirable.

(e) After completing the installation of the final trim balance weights, conduct a vibration survey and vibration levels should meet acceptance limits.

(f) JT8D trim balance report must be completed and filed with the final engine records. See Figure 502 (Sheet 3) for sample trim balance report.

(2) Trim Balance Procedure

NOTE: See paragraph A., General for description of trim balance equipment, equipment setup, and general procedures.

(a) Using PWA 32500 Riveter, install trim balance weights on outer ring of first stage compressor blade positioning plate. See Figure 505 and Tables 503 and 507.

(b) Remove access plate on exhaust fairing and using PWA 32572 Riveter, install required trim balance weights to fourth stage turbine disk. See Figure 504 and Table 508.

NOTE: If exhaust fairing does not incorporate an access plate refer to SB 2030 or SB 5253.

(c) Re-assemble all parts removed.

Blade Retaining Plate Radius =	PN 616645, 639616: 6.050 Inch PN 760297, 793935, 802710: 6.125 Inch PN 803996: 6.115 Inch

Part Number	wt. (oz)	Balance Corr. (oz-in.)
616646	.814	5.0
627070	.4535	3.0
627071	.1415	1.0

Installation Rivet PN 530387. Moment includes rivet weight and c.g. change with height of weight.

No. 1 Hub Balance Weights (For JT8D-15,-15A,-17, -17A,-17R,-17AR Engines) Table 507

Classification Data
Radius = 6.15 Inches
PN 657801

Class	av. wt. (oz)	Moment (oz-in)
1	.037	.25
2	.078	.50
3	.120	.76
4	.162	1.02
5	.204	1.28
6	.246	1.54
7	.289	1.80

Installation Rivet PN 668635. Moment includes rivet weight and c.g. change with height of weight.

Turbine Hub Balance Weights (For JT8D-15,-15A, -17,-17A,-17R,-17AR Engines) Table 508

(d) Classification Instructions and Procedure. See Figure 506. Engines are given different classifications based on vibration amplitude versus speed plot. The classification segregates engines so that most expeditious balance procedure can be used. Those engine speeds given in this section are that of the low rotor and are intended to convey the idea of a vibration peak near the prescribed speed. Slight speed variations of the exact "peak" at which the vibration occurs are

to be expected. The acceptance limit means the O/A (overall) vibration meter reading (40 cps filter). The low rotor component is noted by 1EL. Search out and adjust the engine rpm to the peak vibration for all speed points given in the procedure except TAKE-OFF for JT8D-15,-15A,-17 and -17A and Normal TAKE-OFF for JT8D-17R and -17AR where the engine is set per applicable part power setting curve.

1 Class 1

Symptom: a Inlet pickup over acceptance limits at 6000 N1, or Take-Off/Normal Take-Off.

and b Inlet pickup over acceptance limits between 4000 and 5000 N1.

Classification: Classify as Class 1 if either -

a Inlet pickup over acceptance limits between 4000 and 5000 N1. The 6000 N1 and/or Take-Off/Normal Take-Off points are greater than ± 1.0 mils 1EL.

and b Inlet pickup over acceptance limits at 6000 N1 or Take-Off/Normal Take-Off.

Procedure: Compressor trim. Use inlet pickup. Record "As Is" amplitude and phase angle at T.O./Normal T.O. (8000 N1) only. Log O/A amplitude at 4200 N1, and 6000 N1. Use assumed phase angle lag of 153 degrees and assumed sensitivity of 4.20 oz-in./mil.

Continue with trim balance sequence until 4000 to 5000 N1, 6000 N1, and T.O./Normal T.O. points are acceptable.

2 Class 2

Symptom: Rear pickup over acceptance limits.

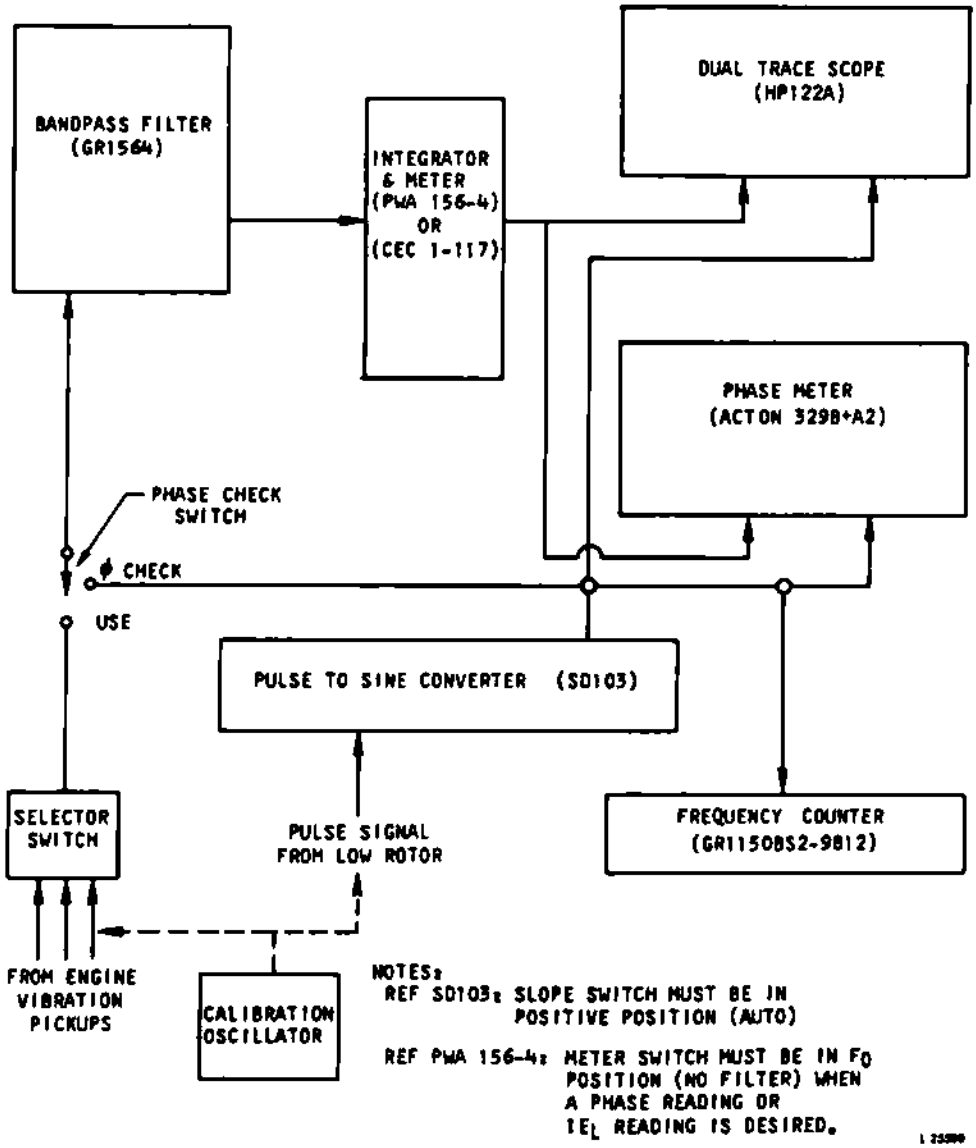
Classification: Classify as Class 2 those engines which have an over limit condition near 6500 N1 on the rear pickup.

Procedure: This mode is predominantly low compressor/ low turbine misalignment. However, rotor unbalance may significantly contribute. A compromise trim balance of the low compressor and/or low turbine may reduce the vibration peak to an acceptable level. Use assumed phase angle lag of 111 degrees and assumed sensitivity of 2.98 oz-in./mil. If the trim balance is not successful, reject the engine.

NOTE: See "Hypothetical Example of Vector Balance Method".

INSTRUMENTATION BLOCK DIAGRAM 1

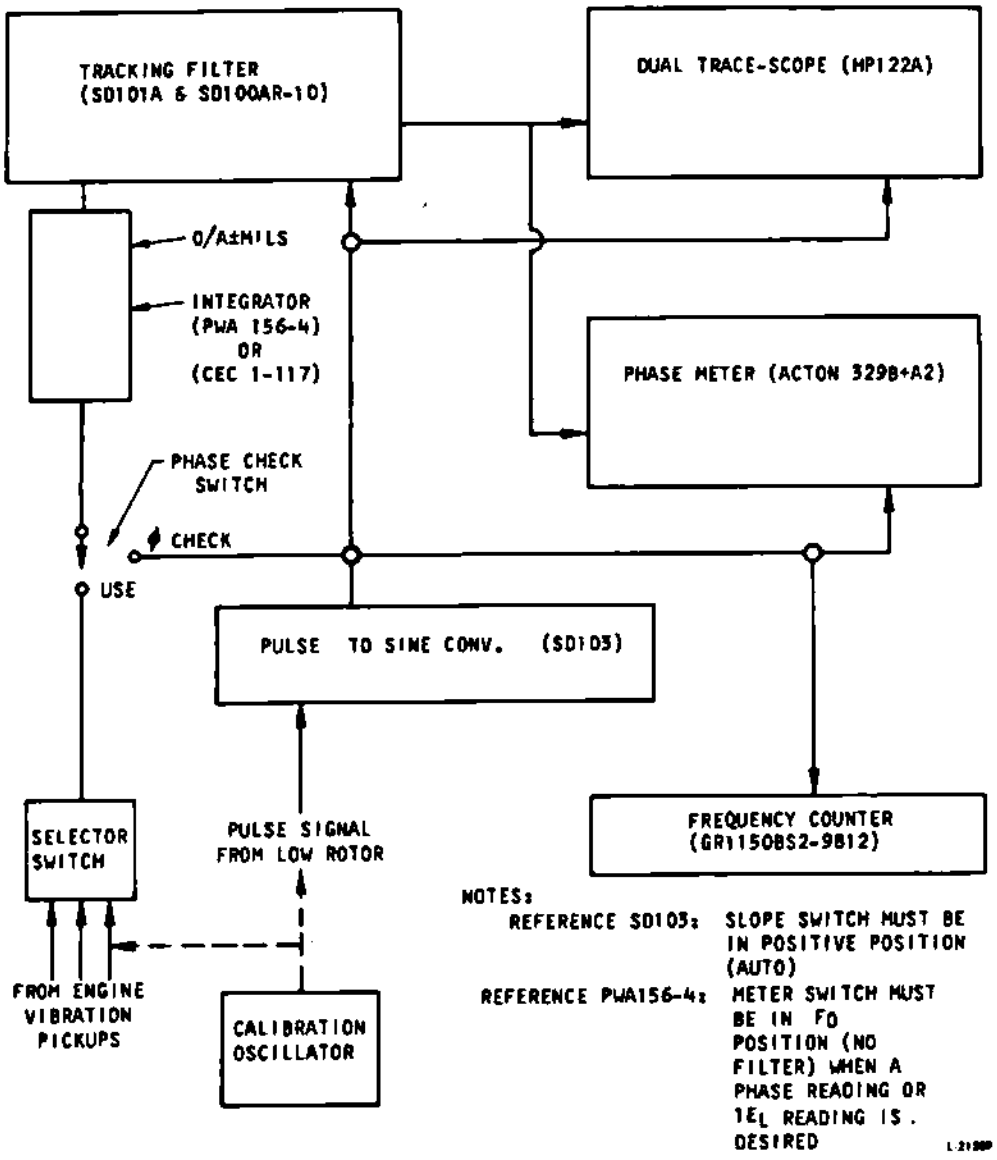
MANUAL SYSTEM


BANDPASS FILTER (GR1564)
INTEGRATOR & METER (PWA 156-4) OR (CEC 1-117)
DUAL TRACE SCOPE (HP122A)
PHASE METER (ACTON 329B+A2)
PHASE CHECK SWITCH
φ CHECK
USE
PULSE TO SINE CONVERTER (SD103)
SELECTOR SWITCH
PULSE SIGNAL FROM LOW ROTOR
FREQUENCY COUNTER (GR1150BS2-9812)
FROM ENGINE VIBRATION PICKUPS
CALIBRATION OSCILLATOR
NOTES:
REF SD103: SLOPE SWITCH MUST BE IN POSITIVE POSITION (AUTO)
REF PWA 156-4: METER SWITCH MUST BE IN F_0 POSITION (NO FILTER) WHEN A PHASE READING OR $1E_L$ READING IS DESIRED.

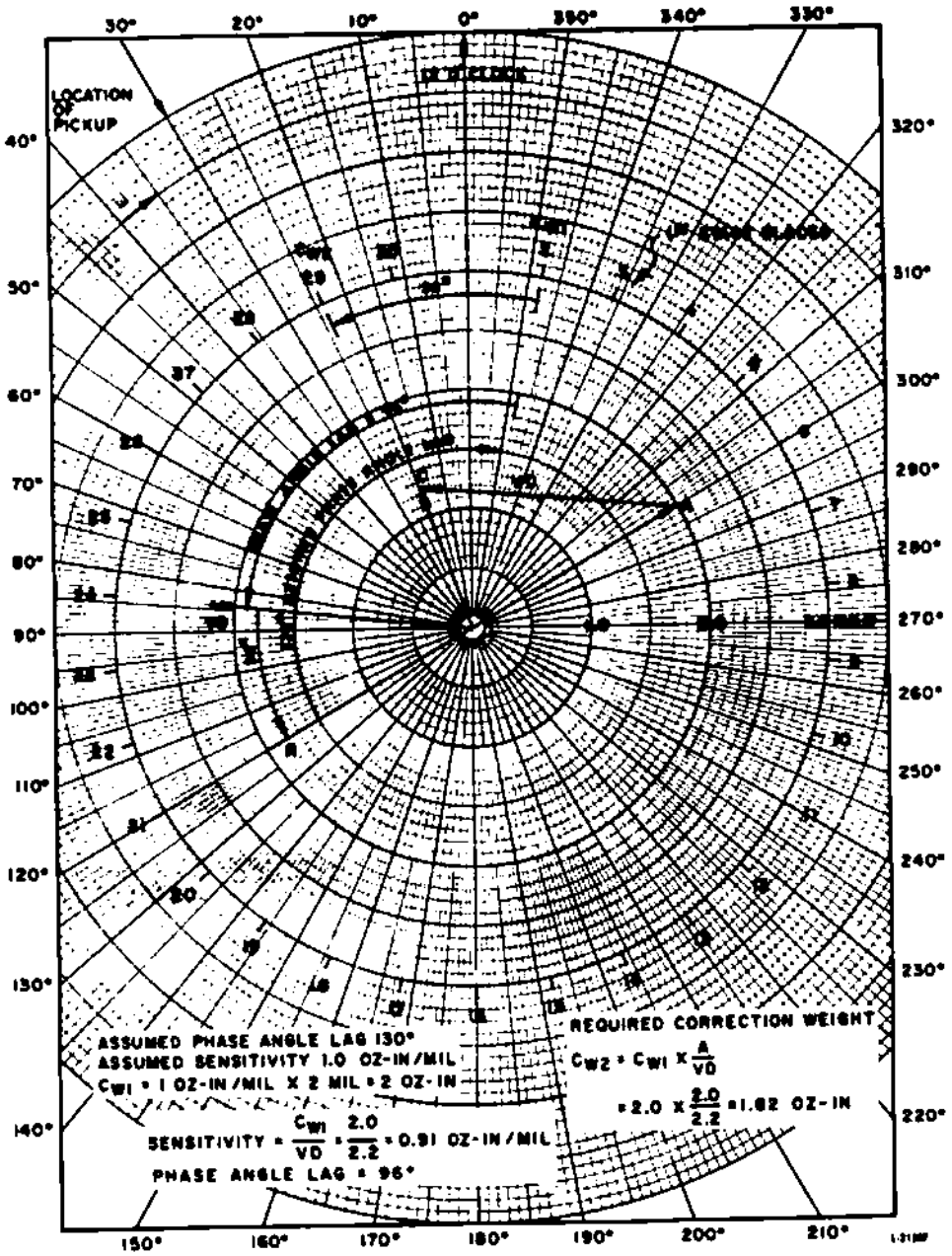
Vibration Instrumentation
Block- Diagram I
Figure 501 (Sheet 1)
(Task 72-00-00-990-031)

INSTRUMENTATION BLOCK DIAGRAM II

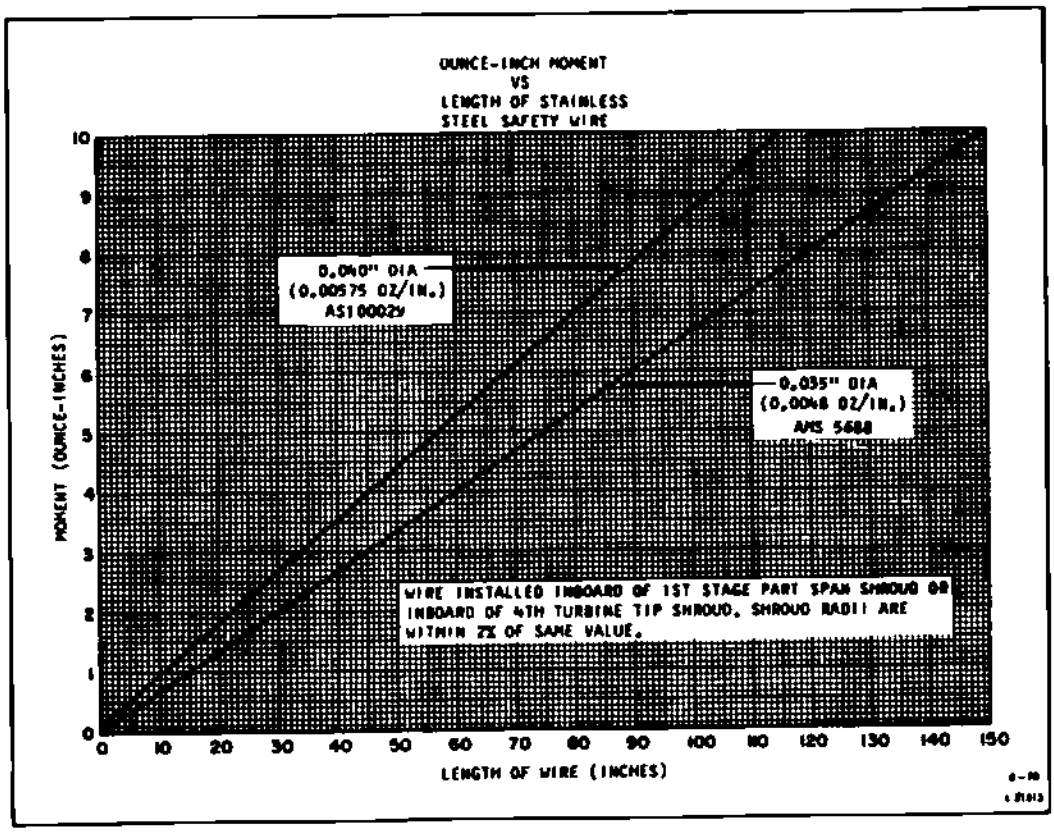
AUTOMATIC SYSTEM



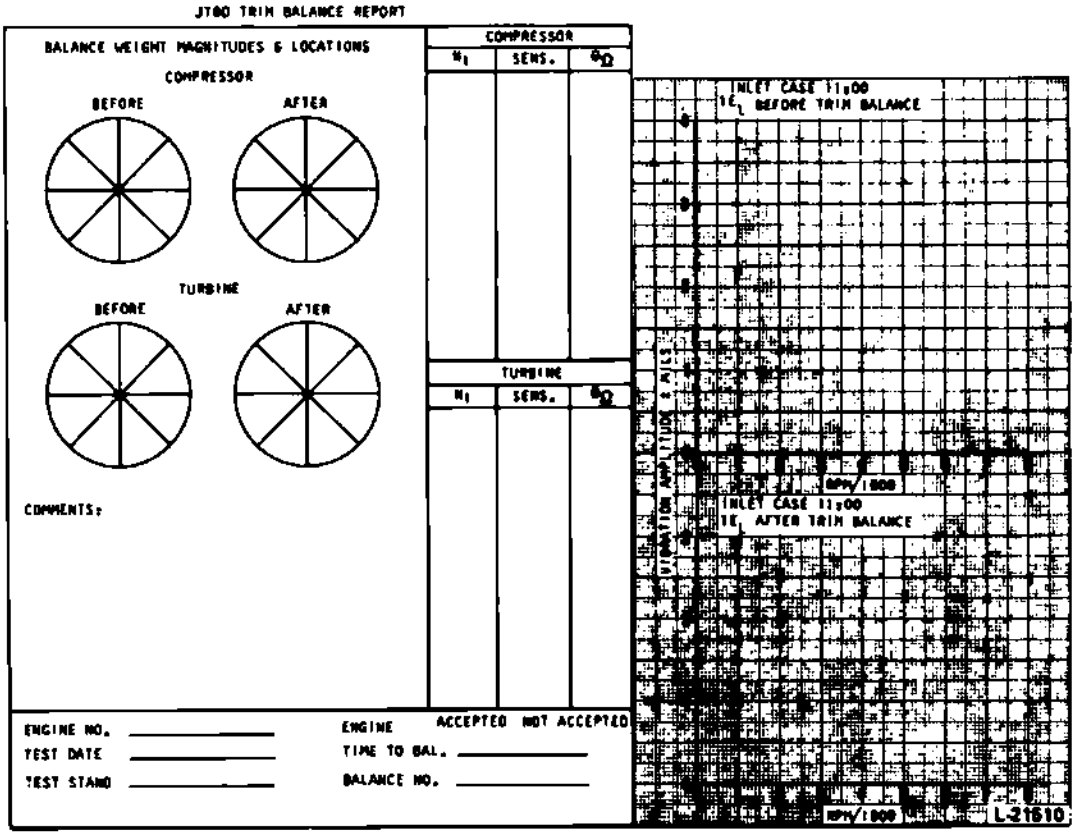
Vibration Instrumentation
Block - Diagram II
Figure 501 (Sheet 2)
(Task 72-00-00-990-031)


LOCATION OF PICKUP
ASSUMED PHASE ANGLE LAG 130°
ASSUMED SENSITIVITY 1.0 OZ-IN/MIL
C_{WI} = 1 OZ-IN/MIL X 2 MIL = 2 OZ-IN
SENSITIVITY = $\frac{C_{WI}}{VD} = \frac{2.0}{2.2}$ = 0.91 OZ-IN/MIL
PHASE ANGLE LAG = 96°
REQUIRED CORRECTION WEIGHT
$C_{W2} = C_{WI} \times \frac{A}{VD}$
= 2.0 X $\frac{2.0}{2.2}$ = 1.82 OZ-IN

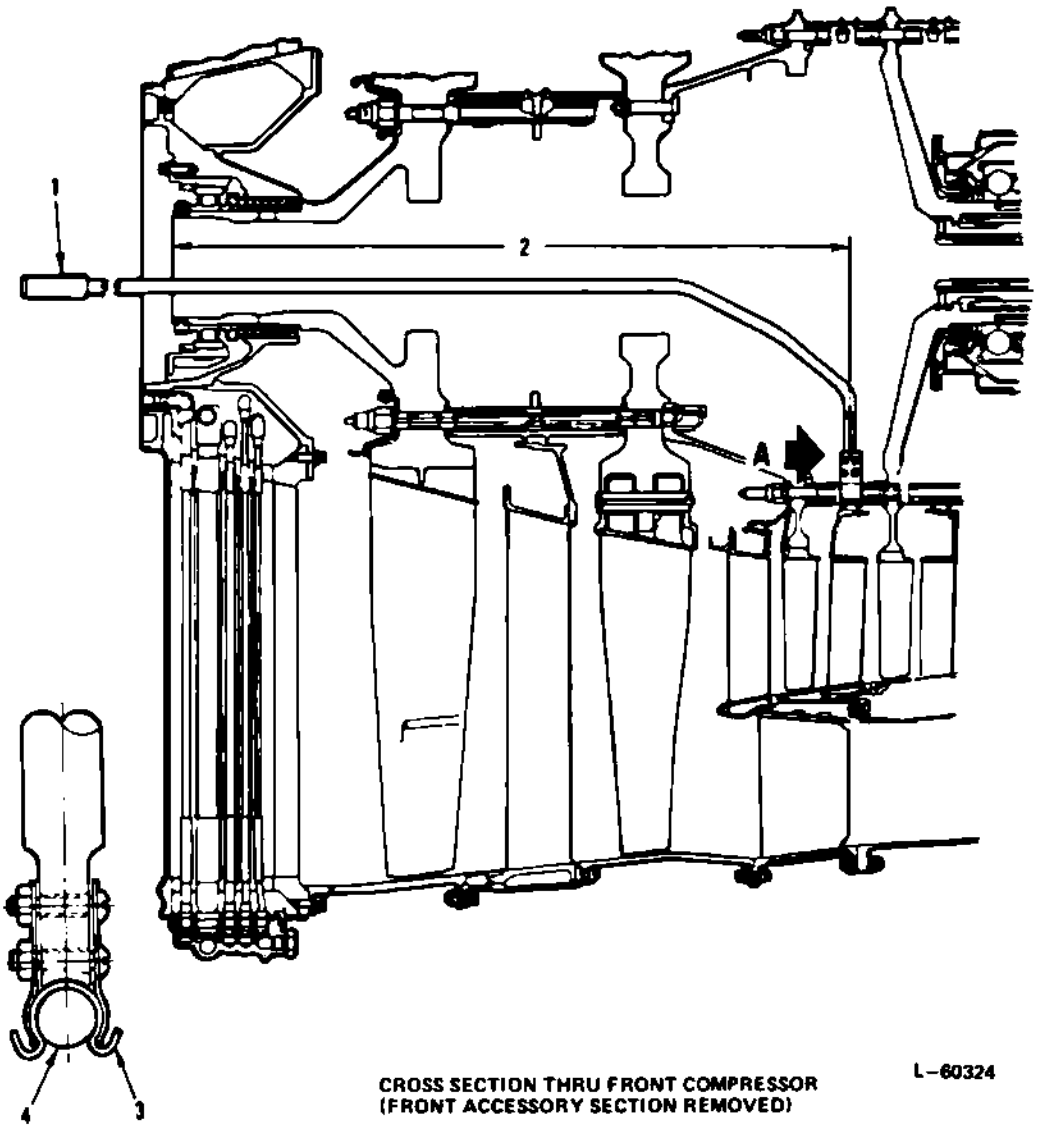
Trim Balance Calculation Diagram
Figure 502 (Sheet 1)
(Task 72-00-00-990-031)



Ounce-Inch Movement
Vs. Length Of Wire
Figure 502 (Sheet 2)
(Task 72-00-00-990-031)



Trim Balance Report
Figure 502 (Sheet 3)
(Task 72-00-00-990-031)



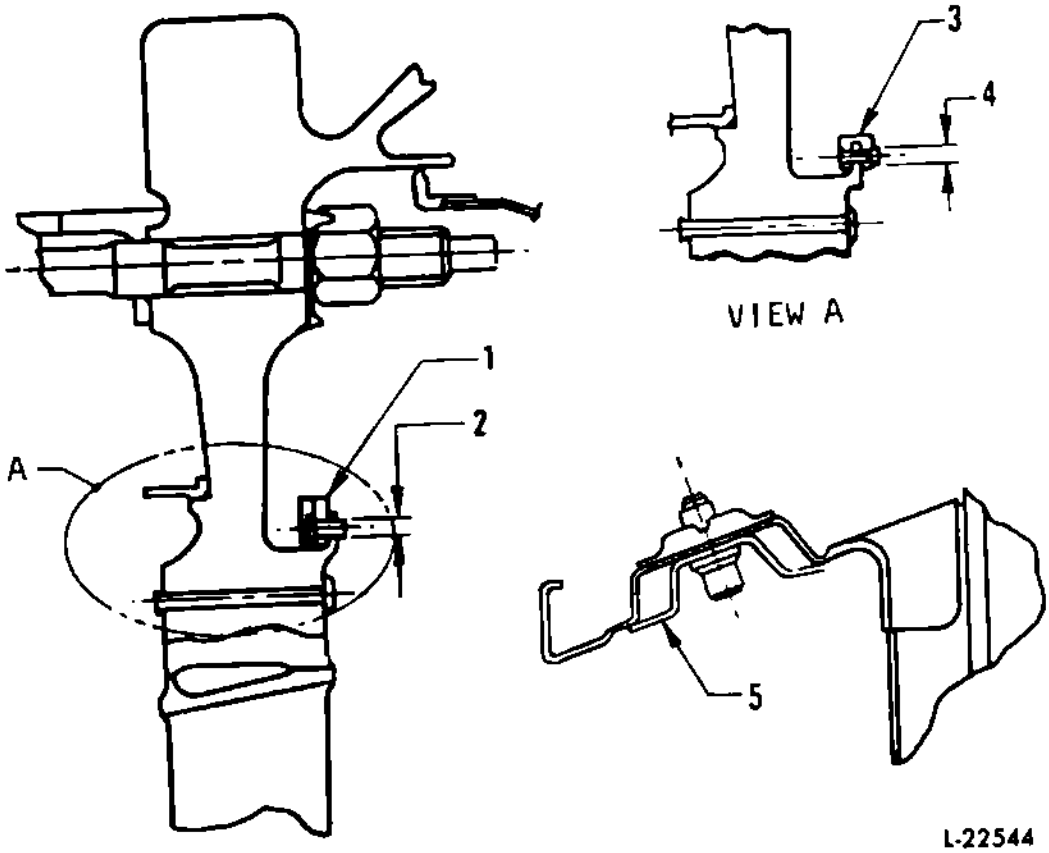
L-60324

CROSS SECTION THRU FRONT COMPRESSOR (FRONT ACCESSORY SECTION REMOVED)

VIEW IN DIRECTION A

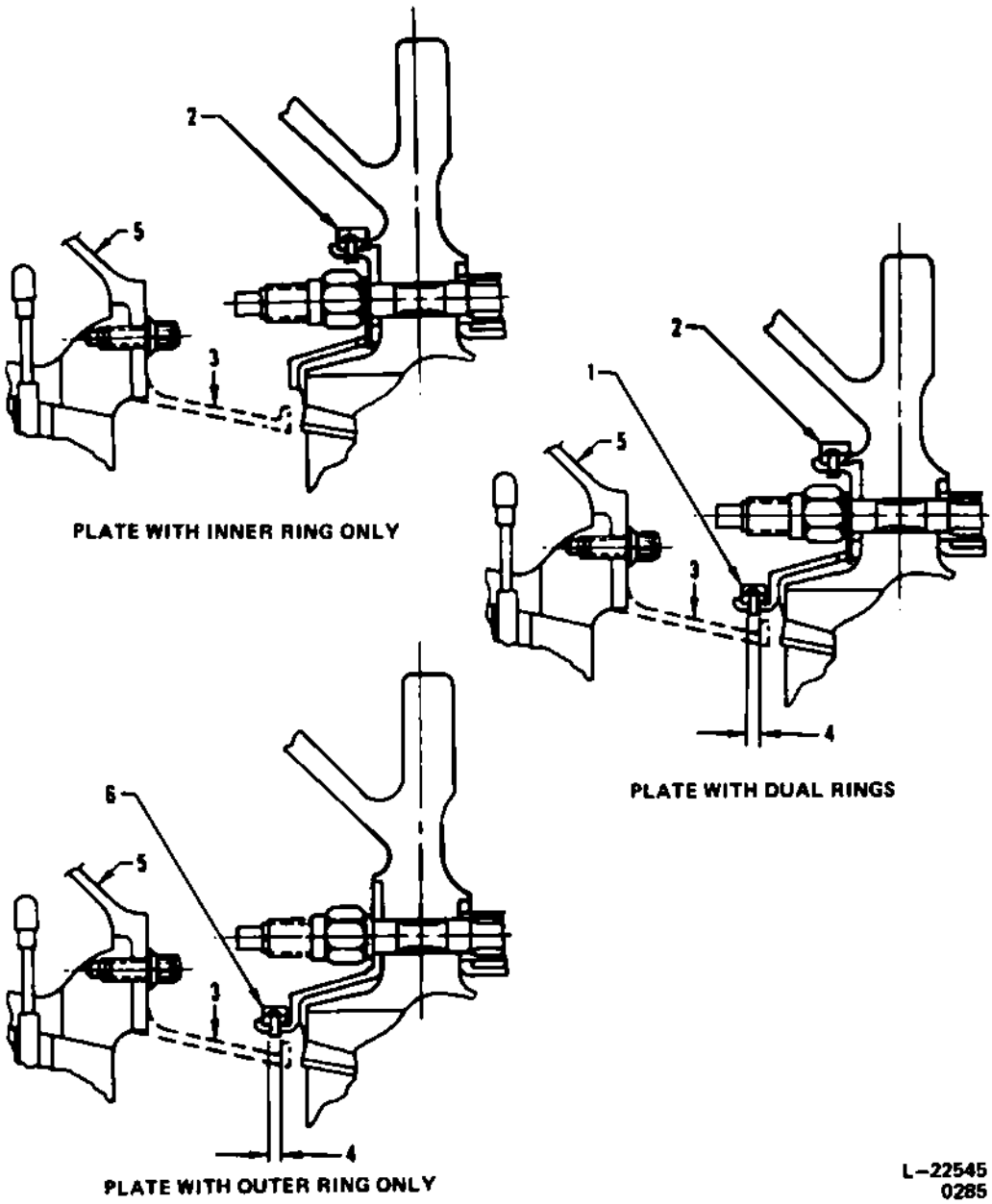
1. PWA 33436 Inserter (View Typical Of PWA 33437 Remover Also)
2. 22 Inches (Make Reference Mark On Remover/Inserter If Desired)
3. Counterweight
4. Spacer Tube (Reference)

Front Compressor
Mid-Plane Trim Balancing
Figure 503
(Task 72-00-00-990-031)



1. Counterweight, PN 528788, 528789, 626398, 626399, Or 576779 (JT8D-1,-1A,-1B,-7,-7A,-7B,-9,-9A,-11 Only).
2. Flare Rivet (PN 528130) or Rivet-Type Counterweight End To 0.160 Inch Diameter Minimum (JT8D-1,-1A,-1B,-7,-7A,-7B,-9,-9A, -11 Only).
3. Counterweight, PN 657801
4. 0.080 Inch Minimum Rivet Flare Diameter
5. Access Coverplate (Reference)

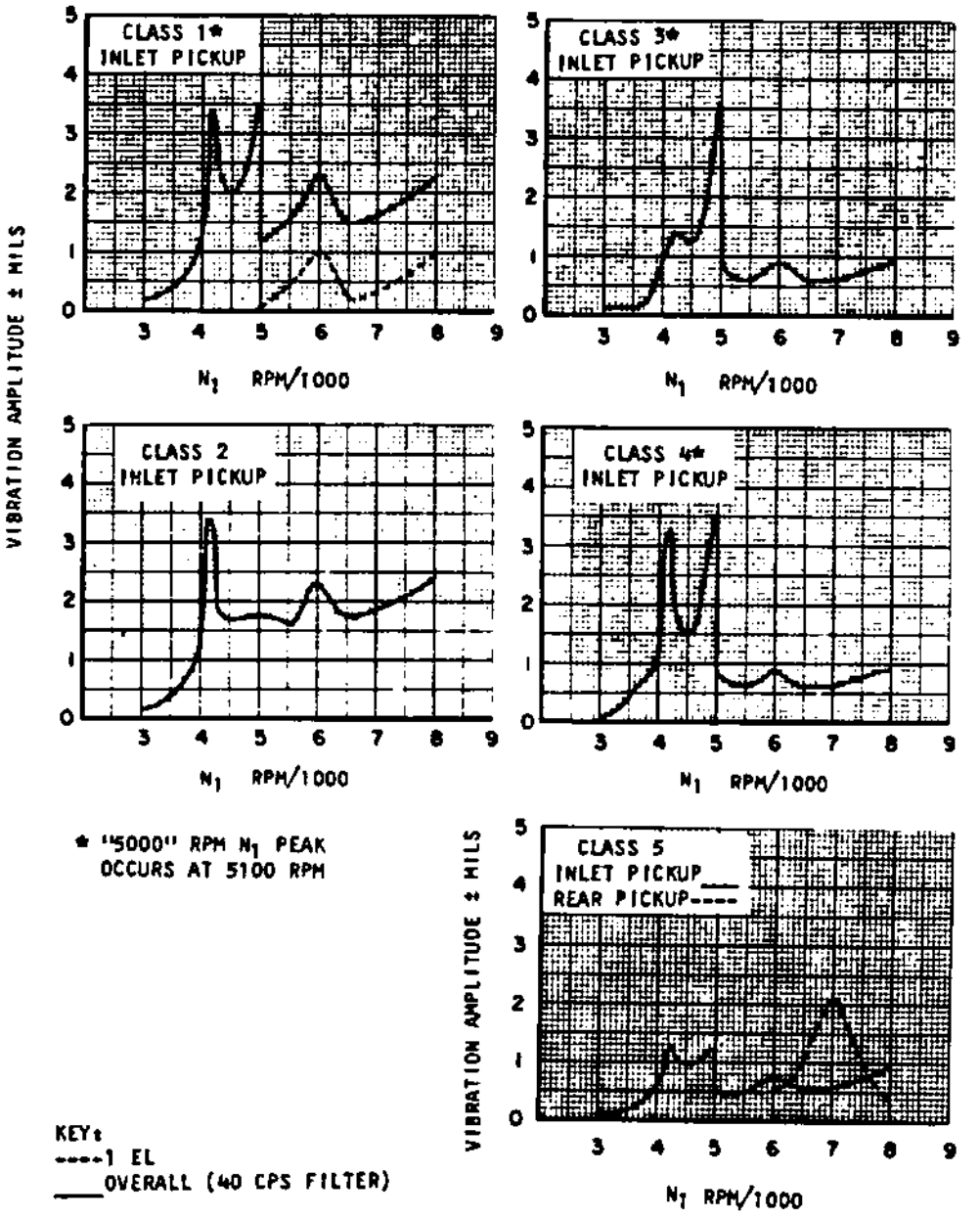
Turbine Trim Balance Area
Figure 504
(Task 72-00-00-990-031)



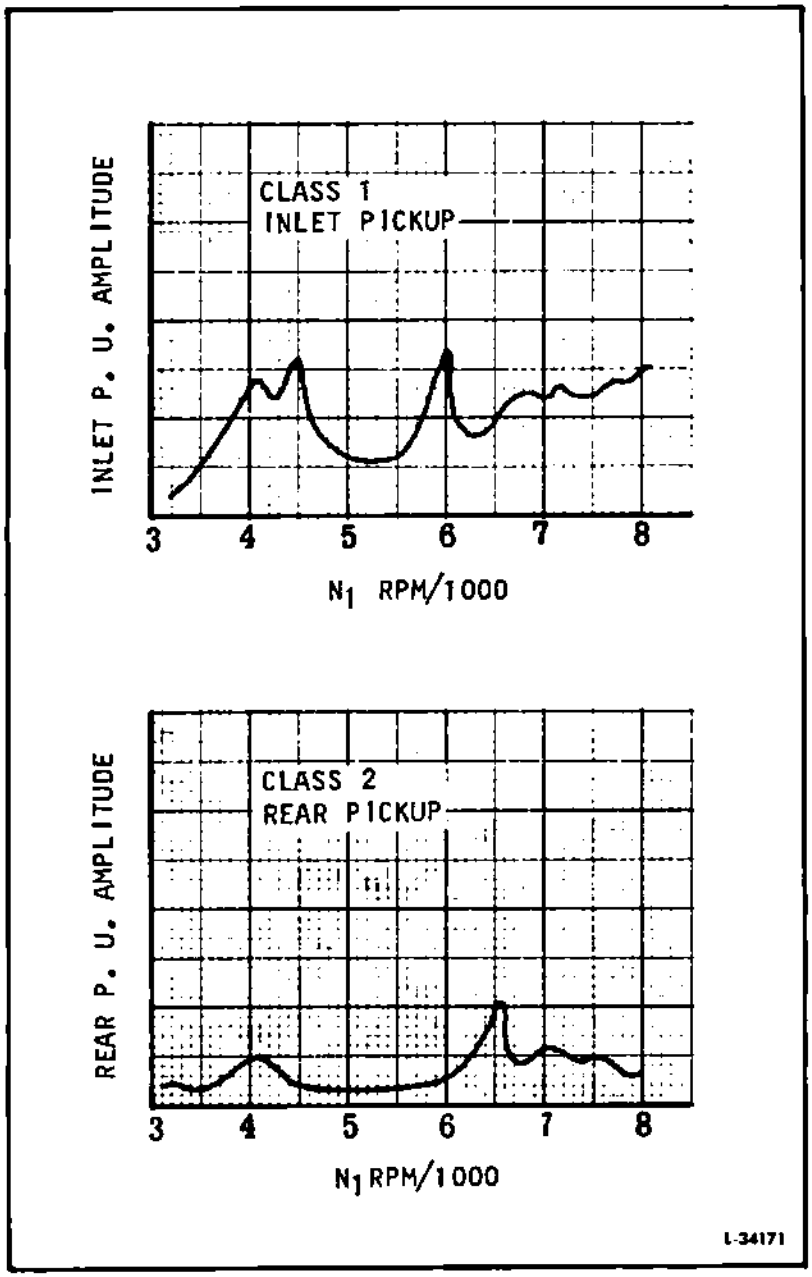
Trim Balance Inlet Access
Figure 505
(Task 72-00-00-990-031)

1. For JT8D-1,-1A,-1B,-7,-7A,-7B: Counterweight Ref. PN 627067, 627068, 627069, Or 794247.
   For JT8D-9,-9A,-11,-15,-15A,-17,-17A,-17R,-17AR: Counterweight Ref. PN 627070, 627071, 616646 Or 794247.
2. For JT8D-1,-1A,-1B,-7,-7A,-7B: Inner Counterweight Ref. PN 528128 Or 528129.
   For JT8D-9,-9A,-11,-15,-15A,-17,-17A,-17R,-17AR: Inner Counterweight
   Reference PN 528128 Or 583176.
   Do Not Disturb Inner Counterweight PN 528129 Or 583176.
3. For JT8D-1,-1A,-1B,-7,-7A,-7B: No. 1 Bearing Rear Support Fairing
   (If So Equipped).
4. Flare Rivet (PN 530387, 0-2 As Required), Or Counterweight (PN 528128) End To 0.160 Inch Diameter Minimum.
5. No. 1 Bearing Rear Support
6. Counterweight PN 794247

Key to Figure 505



Vibration Classification
Curves JT8D-1, -1A, -1B,
-7, -7A, -7B, -9, -9A, -11
Figure 506
(Task 72-00-00-990-031)



Vibration Classification Curves
Figure 507
(Task 72-00-00-990-031)

Task 72-00-00-210-001:

1. Periodic Inspection

A. General
See Figures 601 thru 603.

(1) These inspection procedures are a normal function of operating organizations. They consist of required inspections and minor adjustments necessary on the JT8D engines. The nature and conditions of engine operation determine the time interval between required inspections. For this reason, the intervals described in the Periodic Inspection Chart in this section are labeled Routine, Minor, and Major. If experience dictates a change in these procedures or time intervals, Pratt & Whitney Customer Support Department should be contacted in order to make changes as the situation warrants.

CAUTION: TITANIUM ALLOY WELDMENTS AND ASSEMBLIES SHOULD NOT BE PROCESSED THROUGH TRICHLORETHYLENE DEGREASERS IN ORDER TO AVOID THE POSSIBILITY OF STRESS CORROSION ASSOCIATED WITH THE ENTRAPMENT OF CHLORINE CONTAINING MATERIALS IN TIGHT FITTING AREAS. THIS RESTRICTION ALSO APPLIES TO PARTS SUCH AS TITANIUM DISKS OR HUBS CONTAINING INSERTS, SLEEVES, OR PINS.

(2) Engine compartment cleanliness is important because the intensive mass air flow tends to draw foreign objects into the engine. Thoroughly clean and inspect area after completion of any work. Keep the inlet area free of dirt, oil, and grease, and remove all unused parts, such as nuts, washers, and pieces of lockwire. Immediately cover all apertures resulting from the disconnection of parts. Use external caps on all openings not internal plugs.

(3) Carefully inspect the exterior of the engine without dismantling to ensure that all connections are tight and free from leaks and that lines, tubing, and controls are secure and properly locked.

(4) Check all engine controls for proper operation. Make certain that the linkage from the cockpit controls to the engine units are connected in a manner that permits full and free movement. See that the controls are adjusted to permit overtravel of the control lever to ensure full operation of the engine unit.

(5) Suitable precautions should be taken to prevent foreign objects from coming in contact with the engine during aircraft towing and at all times when not in service. In order to prevent corrosion in the compressor stages and damage to the 2nd stage compressor (fan) disk and blades, it is recommended that the engine inlet or tailpipe be suitable covered whenever the engine is left inoperative for more than six hours. When there is sufficient wind to rotate the engine, it is particularly important to cover the engine immediately.

(6) Until recently all P&W turbo jet engine life limits were expressed in terms of total hours of operation rather than in the number of flight cycles. This policy offered the advantages of a convenient, well-established method of recording part life plus the recognition that several factors affecting disk life are related to hours even through a dominant factor, low cycle fatigue, (LCF), is related to cyclic operation and is not taken into account when total hours accumulated are employed.

(7) Disadvantages of using disk total hours as sole criteria for maximum life have now become apparent, particularly in the instance of many JT8D equipped aircraft due to short haul, frequent take-off aspects of their operation which, in turn, increase the number of complete engine cycles.

(8) The current certificated hourly lives of disks are basically equated to a number of flight cycles based on minimum anticipated average flight time for all operators of the engine. However, local service type operators are now operating jet powered aircraft for the first time and the forecast average flight times of these operators are significantly lower than had been expected and therefore lower than the value used in originally establishing the certificated hourly life limits for engine disks.

(9) The spread between the average flight times for short haul, JT8D operators and average flight times for the intermediate range JT8D operators is much greater than has been experienced on earlier engine models. Because of this large variation in flight times, a reduction in present disk hourly life limits to maintain safe operation for short-haul operators would excessively penalize long- haul operators.

(10) Accordingly, a study has been made of life limits in terms of flight cycles and such limits have been established for each disk in the JT8D engine. Since other factors such as high frequency fatigue and metallurgical changes are related to time rather than flight cycles, a maximum life limit for each disk in terms of hours will also be specified.

(11) In general, shorter flight operators' disk life will be governed by cyclic limits while longer flight operators will be able to operate to hourly limits without exceeding cyclic values. New limits have been certificated by the Federal Aviation Agency and are currently in effect.

(12) The following definitions and regulations apply to the use of the new limits:

(a) A cycle is defined as any flight (i.e. take-off and landing) regardless of duration and whether or not reversers are used on landing. This applies to engines in normal airline usage including a moderate amount of routine pilot training. Any extended special usage such as might be incurred by assignment of one aircraft to exclusive pilot training use for several months or assignment of an engine to a flight test vehicle requires that any throttle excursion equal to or greater than idle-to-maximum continuous, in flight or on the ground, be recorded as a cycle in obtaining the total cycles on the engine disks. Touch-and-go landing and take-off operation, is of course, included in this definition. Cyclic records must be recorded for each disk for all operation.

(b) Operators who can obtain cyclic histories of disks currently in service from available records should use this method to establish current total number of cycles on each disk. Where such records are not available, hours accumulated to date on disks currently in service must be converted to cycles. The number of cycles of an in-service disk may be calculated by dividing disk total operating time in hours by average flight lengths (in hours) experienced by disk in operation to date.

Cycles = Total disk hours/Average flight length (hours)

(c) Operating hours must continue to be recorded for each disk as it has been in the past.

(d) Total accumulated cycles and hours must be marked on each disk at each removal from an engine. For disk currently in service whose part cyclic history was obtained by converting current hours, total cycles will be the sum of the cycles obtained by conversion and the cycles recorded thereafter.

(e) Service life of disks is limited to, and must not exceed, the specified hours or cycles, whichever occurs first. See Chapter 5-10-00 in the JT8D Engine Manual for disk life limits. Refer to Overhaul Standard Practices Manual for additional information on Service Life.

(f) Disks must be retired when either cyclic or hourly limit is reached.

(13) Particular attention must be paid to inspection of rotating parts if an engine has exceeded maximum (operating) engine speed.

NOTE: Engines exceeding overspeed limits must be sent to overhaul for complete inspection.

Task 72-00-00-210-002:

2. Specific Periodic Inspection

A. Tailpipe

(1) Routine visual inspection of tailpipe for evidence of metallizing from blade and stator interference should be made.

B. Inlet

(1) Routine visual inspection of the inlet duct to determine if the engine has suffered damage from foreign material should be made.

C. Draining Moisture Trap Housing

(1) Drain Plug Type (Reference SB 1605)

(a) Remove drain plug and packing from bottom of moisture trap (mounted on front of fuel control) and discard old packing.

(b) Drain all accumulated moisture from trap.

(c) Look to be sure there is no blockage of the drain hole. Remove all dirt or unwanted material.

(d) Coat new packing with PWA 36500 Assembly Fluid and place seal on plug.

CAUTION: ENSURE THAT IF PLUG INCORPORATES 0.020 INCH HOLE CLEAR THROUGH, HOLE IN PLUG IS OPEN AND NOT OBSTRUCTED. DO NOT BLOCK HOLE WITH PLUG LOCKWIRE; LOCKWIRE SHOULD BE PASSED THROUGH ONLY ONE SIDE OF PLUG, NOT COMPLETELY ACROSS PLUG.

(e) Install drain plug and packing in bottom of moisture trap. Torque plug and secure with lockwire.

(2) Rod and Cotterpin Type

(a) Remove cotterpin and unfasten nut from bottom of moisture trap (underneath engine, inboard side of fuel control).

(b) Carefully draw housing straight downward out of cover.

(c) Drain all accumulated moisture.

(d) Look to be sure there is no blockage of the drain hole. Remove all dirt or unwanted material.

(e) Install new packing, coated with PWA 36500 Assembly Fluid, on OD groove of moisture trap cover rod.

(f) Install new packing, coated with PWA 36500 Assembly Fluid, on OD groove of moisture trap housing.

(g) Insert moisture trap housing straight up into cover, being careful not to disrupt packings.

(h) Secure housing in place with washer and nut.

(i) Torque nut. Secure nut with cotterpin.

Periodic Inspection Chart

Component	Nature of Inspection	Inspection Time Routine	Minor	Major	Remarks
ENGINE GENERAL					
External Tubing, Hoses and Electrical Leads	a. Security of all accessible connections, clamps, and brackets.		X	X	
	b. Evidence of chafing and wear.		X	X	
	c. Evidence of fuel or oil leakage.	X	X	X	

Periodic Inspection Chart

Component	Nature of Inspection	Inspection Time			Remarks
		Routine	Minor	Major	
Burner Pressure Sensing Line Moisture Trap	a. Presence of water.		X	X	
	b. Icing	X			Moisture trap should be checked and drained periodically as a precaution-ary measure. See Task 72-00-00-210-002
	c. Dirt in the drain hole.		X	X	
COMPRESSOR					
Inlet Guide Vanes	Nicks, dents or other evidence of passage of foreign material.	X	X	X	
Fan Inlet Case Vent Plug Area	Check for evidence of internal oil leakage (i.e. when engine not operating.)				See Task 72-00-00-210-016

Periodic Inspection Chart

Component	Nature of Inspection	Inspection Time Routine	Minor	Major	Remarks
Compressor Blades* (Stages 1-3)	a. Rotate compressor and inspect all visible compressor fan blades for foreign object damage. For limits, see Figures 601, 602, and 603.	X	X	X	

NOTE: Compressor blade blend limits as specified in this manual (see Figures 601, 602, and 603 of this task) are evaluated from the standpoint of structural integrity only and use of a substantial number of blades reworked at or near maximum limits, or blades having many reworked areas may adversely affect compressor efficiency and engine performance.

NOTE: For flyback limits, see Task 72-00-00-210-007.

	b. On 2nd stage blades, check the tip movement by measuring the distance betwee end points of blade travel about retaining pin. Max. permissible movement is 2.000 inches for JT8D-1,	Perform this inspection whenever the 1st stage disk and blade assembly is removed or when the 2nd Stage blades require blending.			

Periodic Inspection Chart

Component	Nature of Inspection	Inspection Time Routine	Minor	Major	Remarks
(CONTINUED)					
	-1A,-1B, -7,-7A, and -7B engines 2.500 inches for JT8D-9, -9A,-11, -15,-15A, -17,-17A, -17R,-17AR engines.				
	c. On 2nd stage blade platform edges to avoid 2nd stage blade interlock, it is permissible	* This inspection is contingent on condition of engine inlet. If foreign object damage is indicated by visual inspection of inlet, then perform inspection.			
	to hand blend 0.020 - 0.030 inch radius.**	**Fan blade blend length must be four times the depth.			
Compressor (Fan) Vanes	Nicks, dents or other evidence of passage of foreign material.		X	X	X

COMBUSTION CHAMBER, TURBINE AND EXHAUST SECTION

Periodic Inspection Chart

Component	Nature of Inspection	Inspection Time Routine	Minor	Major	Remarks
Third Stage Turbine Blades (JT8D-1, -1A,-1B, -7,-7A, -7B,-9, and -9A)	Axially displaced blades. See Task 72-00-00-210-013		X	X	
Fourth Stage Turbine Blades	Dents, nicks or other evidence indicating passage of foreign material. NOTE: Refer to MAN JT8D-1-06 for turbine blade shroud looseness checks.	X	X	X	
Turbine Exhaust Struts	a. Distortion, cracks nicks and erosion. b. Inspect for loose fairing due to pin and/or bushing wear. See Task 72-54-00-220-001 Turbine Exhaust Case Assembly - Maintenance Practices.	X	X	X	

Periodic Inspection Chart

Component	Nature of Inspection	Inspection Time Routine	Minor	Major	Remarks
Combustion Chamber Fiberoptic	Fiberoptic Inspection through No. 4 and 7 Combustion Chamber Spark Igniter Holes.	See ASB 5639			1. See Task 72-00-00-210-014 and inspect as follows: a. Combustion chambers. b. Combustion chamber inner and outer ducts. c. First stage NGVs (Airfoil section). d. Fuel nozzle nuts for signs of burning.
Combustion Chamber Retaining Pin	Loose Combustion Chambers.				1. Inspect for combustion chamber axial looseness as follows: a. Insert long fiber or brass drift through igniter plug boss at each side and use drift as lever to check fore and aft

Periodic Inspection Chart

Component	Nature of Inspection	Inspection Time Routine	Minor	Major	Remarks
(CONTINUED)					
					movement of No. 4 and No. 7 combustion chambers.
NOTE: Looseness of igniter plug guide in igniter boss of combustion chamber does not indicate chamber mount pin wear. Position drift so that igniter plug guide is held tight in chamber boss so that guide motion will not be mistaken for chamber motion.					
					b. If fore-aft movement of No. 4 and 7 chambers checked through igniter plug boss exceeds 0.010 inch, remove and dimension-ally inspect for wear of retaining pins and lugs. See Removal/ Install-ation, Fits and Clearances Ref. 59.

Periodic Inspection Chart

Component	Nature of Inspection	Inspection Time Routine	Minor	Major	Remarks
NOTE: Also check for excessive clearance (0.014 inch maximum) between combustion chamber rear liner and support sleeve.					
					2. If crossover tubes (from No. 4 and 7 chambers to mating chambers) reveal wear, all chambers should be removed and dimension-ally checked. See Removal/ Install-ation Fits and Clearances Ref. 11.
NOTE: Referenced (loose) fit above may be obtained by stretching chamber rear liner to dimensions given in Ref. 748 utilizing locally fabricated tooling.					
Combustion Chamber Outer Case PN 490547 Thru 767279-001	Rear Flange/Boss Cracks	See ASB 6228			Inspect case flange and bosses for cracks by eddy current or ultrasonic methods. Refer to ASB 6228.

Periodic Inspection Chart

Component	Nature of Inspection	Inspection Time Routine	Minor	Major	Remarks
Combustion Chamber Outer Case PN 796761 Thru 808125-002 (Except PN 806748)	Rear Flange/Boss Cracks	See ASB 6230			Inspect case flange and bosses for cracks by eddy current or ultrasonic methods. Refer to ASB 6230.
Combustion Chamber Outer Case PN 806748	No On-Wing Inspection Necessary				
ACCESSORY SECTION					
Accessory and Component Drives Gearbox	Check for oil leaks.		X	X	
OIL SYSTEM					
	CAUTION: DO NOT MIX DIFFERENT BRANDS OF OIL WHEN CHANGING OIL OR WHEN ADDING OIL BETWEEN CHANGES. THE CHEMICAL STRUCTURE OF DIFFERENT BRANDS OF SYNTHETIC OIL MAY DIFFER SUFFICIENTLY TO MAKE THEM INCOMPATIBLE.				
Oil	Check oil level.	X	X	X	See Task 72-00-00-210-015 which follows

NOTE: Oil should be checked and added as soon as possible after engine shutdown but no later than two hours after shutdown.

Periodic Inspection Chart

Component	Nature of Inspection	Inspection Time			Remarks
		Routine	Minor	Major	
Oil Strainer	a. Metal particles and other foreign matter.		X	X	See Task 72-00-00-210-015 which follows
	b. Damaged screens and spacers.*		X	X	
	c. Proper installation and leakage.*		X	X	
	d. Adequate assembly tension (cannot rotate screen elements by hand.)*				
* Screen-and-Spacer (175 Micron) Type					
Oil Cooler	Internal.	X	X	X	
No. 4 Bearing Scavenge Tube	Make a check of the No. 4 bearing scavenge tube temperature indicators.				If the engine is installed in a Boeing 727 and does not have SB 5945 and SB 5514 (Rev. 7 or subsequent) parts, be sure to do the inspection procedures in ASB 5944 before you continue to

Periodic Inspection Chart

Component	Nature of Inspection	Inspection Time Routine	Minor	Major	Remarks
(CONTINUED)					
					operate the engine.

Task 72-00-00-210-003:

3. Borescope Inspection - General

See Tables 601 and 602.

A. See Table 601 for general information about JT8D borescope inspection. This table shows the access to the engine for borescope inspection and the parts of the engine which are in view at these positions.

B. Table 602 shows the number of blades or vanes in each compressor and turbine stage (it is not possible to see all stages of blades and vanes by borescope). This is to help the operator start and complete a borescope inspection sequence.

Borescope Access	Angular Position (Clockwise From The Rear)	Parts In View For Inspection
Through the Inlet	--	1st Stage Compressor Blades, 1st Stage Compressor Vanes, 2nd Stage Compressor Blades, 2nd Stage Compressor Vanes, 3rd Stage Compressor Blades
Front Compressor Outer Fan Duct (Engines With SB 1133)	130 Degrees, 235 Degrees	Rear of 6th Stage, Front of 7th Stage Compressor Blades
Rear Compressor Outer Fan Duct (6th Stage Air Bleeds)	30 Degrees, 330 Degrees	Rear of 6th Stage, Front of 7th Stage Compressor Blades

Borescope Access To The Engine
Table 601

Borescope Access	Angular Position (Clockwise From The Rear)	Parts In View For Inspection
Combustion Chamber And Turbine Fan Duct (Igniter Plug Bosses)	120 Degrees, 240 Degrees	Rear of 13th Stage, Fuel Nozzles, Combustion Chambers, Inner and Outer Ducts, Front of 1st Stage Turbine Vanes and Blades
Through the Exhaust	--	4th Stage Turbine Blades, 4th Stage Turbine Vanes, Rear of 3rd Stage Turbine Blades

Borescope Access To The Engine
Table 601 (Continued)

Stage	No. Of Blades	No. Of Vanes
Compressor		
1st (JT8D-1 thru -7)	30	51
1st (JT8D-9 thru -17AR)	27	51
2nd (JT8D-1 thru -7)	42	42 (aluminum) 63 (steel)
2nd (JT8D-9 thru -17AR)	40	42
3rd	64	67 (aluminum) 76 (steel)
4th	62	75
5th	64	79
6th	62	N/A (Int. Case Struts)
7th	60	52
8th	58	56
9th	60	58
10th	64	84
11th	70	102
12th	80	114 (early engines) 109 (current engines)
13th	74	99
Turbine		
1st (JT8D-1 thru -17R)	80	53 (early -1 thru -9) 46 (current engines)
1st (JT8D-15A,-17A,-17AR)	64	46
2nd	88	95

Blade And Vane Numbers By Stage
Table 602

Stage	No. Of Blades	No. Of Vanes
(CONTINUED)		
3rd	92	79
4th	74	77

Blade And Vane Numbers By Stage
Table 602 (Continued)

Task 72-00-00-210-004:

4. First Stage Compressor Blade Bow Measurement

A. Procedure
See Figure 601 (Sheet 1).

(1) Place one end of six inch rule or straight edge on convex side of leading edge approximately perpendicular to airfoil so end of rule is in line with center of convex leading edge contour near midspan shroud and other end of rule touches forward blade tip.

NOTE: JT8D-15A,-17A,-17AR blades feature more pronounced convex contour on leading edge near midspan shroud, in addition to 0.057 inch of nominal bow in airfoil leading edge between midspan shroud and blade tip. These features are part of JT8D-15A,-17A,-17AR blade design and must be taken into account in assessing blade bow in following step.

(2) Measure gap between rule or straightedge and blade leading edge as shown in figure. Limits are as follows:

(a) JT8D-1,-1A,-1B,-7,-7A,-7B,-9,-9A,-11,-15,-17,-17R: 0.125 (1/8) inch maximum.

(b) JT8D-15A,-17A,-17AR: 0.182 (approximately 3/16) inch maximum.

NOTE: Basic bow limit of 0.125 inch maximum applies to blades of all models but observed gap limit of 0.182 inch for JT8D-15A,-17A,-17AR includes 0.057 inch of nominal bow in blade design.

Task 72-00-00-210-005:

5. First Stage Compressor Blades Service and Repair Limits

See Figure 601 (Sheets 2 through 9).

A. Blades may be continued in use provided limits given in figure are met.

NOTE: Make note in engine records that blend repaired blades shall be glass bead peened, per engine manual instructions, the next time blades are accessible in shop.

NOTE: Surface damage blend limits also apply to blades which have been machined to minimum chord, which have been recontoured or in which a leading edge insert has been installed per the engine manual. It is acceptable for such restored blades to display a smooth transition from maximum to minimum chord in area where insert repair runs out.

NOTE: Blend depth should be measured relative to the point where blend radius runs out to existing leading edge contour (Figure 601, Sheet 3), both sides. Spanning a larger area along leading edge provides erroneous blend depth indications.

NOTE: For Post SB 6072 JT8D-15A,-17A, and -17AR engines: In an assembled rotor, these blades will have a loose fit between adjacent midspan shroud faces. This is a normal and acceptable condition for these blades.

Task 72-00-00-210-006:

6. First Stage Compressor Blade Foreign Object Damage (FOD), Continue-In-Service And Flyback Limits

A. General

CAUTION: AFTER ANY F.O.D. (EITHER REPAIR REQUIRED OR REPAIR NOT REQUIRED) ALL LIMITS ARE VALID ONLY IF CONTINUED USE OF DAMAGED BLADES DOES NOT CAUSE EXCESSIVE IMBALANCE OR VIBRATION DURING ENGINE OPERATION. THE USE OF SUCH BLADES COULD ADVERSELY AFFECT COMPRESSOR EFFICIENCY AND ENGINE PERFORMANCE. NO MORE THAN SIX (6) DAMAGED FAN BLADES (REPAIRED AS SHOWN IN FIGURE 601 (SHEET 6, 7, 8 OR 9) OR NOT REPAIRED AS SHOWN IN FIGURE 601 (SHEET 4)) CAN BE OPERATED IN AN ENGINE. THERE IS NO QUANTITY LIMIT FOR BLADES DAMAGED, AS SHOWN IN

FIGURE 601 (SHEET 5), THAT CAN BE OPERATED IN AN ENGINE.

NOTE: You must only remove the minimum amount of material that is necessary to completely remove the blade damage. You must obey all the specifications, limits and dimensions described in this chapter for 1st stage F.O.D. repair. Blades damaged more than these limits must be removed from the engine.

NOTE: JT8D-15A,-17A and 17AR fan blade assembly PN 808231, (detail blade PN 844801) which includes SB 5882 has a thicker airfoil leading edge near the platform for improved impact damage resistance. This will be a "cut-back" area on the leading edge near the platform. These fan blades will not have the "straight" appearing leading edge as to other JT8D 1st stage fan blades.

B. Specific Limits For Foreign Object Damage (F.O.D.) That Do Not Require Repair To Continue-In-Service.
See Figure 601 (Sheets 4 and 5).

(1) Blades with tip bends confined by area and dimensions shown in Figure 601 (Sheet 4), may continue in service. Any crack indications found during routine inspection are cause for blade removal.

(2) See Figure 601 (Sheet 5) for acceptable damage limits. There is no limit on the quantity of these blades than can operate in an engine.

C. Specific Limits For Blade Tip F.O.D. That Do Require Repair.
See Figure 601 (Sheets 6 and 7).

(1) Blades with F.O.D. damage confined to the blade tip must be repaired for continue in service, within the indicated limits. The following conditions must be done and are mandatory.

(a) Cut off the minimum amount of material that is necessary to completely remove the tip damage. Cut as shown in Figure 601 (Sheet 6) and as specified by Indexes 1, 2 or 3. You can only cut parallel and up to the maximum dimension of any one of the three Indexes 1, 2 or 3. If the tip damage can not be removed by the above limits, you can remove the damage as shown in Figure 601 (Sheet 7). You can cut up to the maximum

dimensions of all of the Figure 601 (Sheet 7) indexes. Any crack indication found during routine inspection is cause for blade removal.

D. Specific Limits For Leading Edge F.O.D. That Do Require Repair.
See Figure 601 (Sheet 8).

(1) Blades may be repaired along the leading edge as shown in Figure 601 (Sheet 8). Blades repaired by this step may continue-in-service. Any crack indication found during routine inspection is cause for blade removal.

E. Specific Flyback Limits, For Leading Edge Damage, That Do Require Repair.
See Figure 601 (Sheet 9).

CAUTION: NO EXTENSION OF DEPTH OR TIME LIMITS IS PERMITTED FOR F.O.D. ON REGION FROM ONE AND A HALF 1.500 INCHES ABOVE BLADE ROOT PLATFORM TO ONE 1.000 INCH ABOVE MIDSPAN SHROUD. SEE FIGURE 601 (SHEET 9).

(1) Blades must be repaired along the leading edge as shown in Figure 601 (Sheet 9). Blades repaired per this step can be continued in service for maximum of twenty (20) hours. After the blade has operated for the permitted 20 hours it must be removed from service and can not be used or repaired again. No blending is permitted within 1.500 inch of blade root platform.

F. Repair Procedure

(1) All repair cuts shall have a length to depth ratio greater than 4, and shall have smooth continuous contours with a 0.250 inch minimum radius.

(2) Leading edge of repaired area must be blended as closely as possible to original radius.

(3) Examine the repaired area by SPOP 70 (ultra-high sensitivity) portable fluorescent penetrant (see Chapter/Section 70-00-00, Standard Practices Manual). There must be no crack indications. Time limits for fluorescent penetrant inspection are as follows:

(a) If a maintenance base at which the blend repair is done cannot do the fluorescent penetrant inspection:

1 Do the fluorescent penetrant inspection no more than 50 hours after the repair.

2 If no crack or tear was found in the blade material before blade blend repair, visual inspection is sufficient.

3 No repeated inspections are necessary.

(b) If the blend repair is done at a maintenance base which can do the fluorescent penetrant inspection:

1 If a crack or tear was found in the blade material before the blade blend repair, do a SPOP 70 fluorescent penetrant inspection of the blade immediately after the repair.

2 If no crack or tear was found in the blade material before blade blend repair, visual inspection is sufficient.

3 No repeated inspections are necessary.

(4) Blending

(a) Insert a piece of scrap sheet stock between blade tip and fan case.

CAUTION: AREA TO BE REWORKED WITH CUT-OFF WHEEL MUST BE COMPLETELY MASKED TO ENSURE THAT NO METAL SPLATTER CAN STRIKE ANY OTHER BLADE OR DISK SURFACE.

(b) Using a two inch diameter cut-off wheel, remove major portion of material to be removed.

(c) A minimum of 0.060 inch material must be left for hand filing and polishing to ensure removal of any heat affected areas.

(d) Use a Norton A601-0BNA2 or Carborundum Co. A-60-TB2067 cut-off wheel in an ARO air chuck model 7015S which has an operating speed of 18,000 rpm maximum. An alternate method for rough cut instead of cut-off wheel would be to use a 3/16 inch rotary file.

(e) Hand file and polish as above.

(f) The above procedure applies to blades that are repaired by the limits shown in Figure 601 (Sheets 6, 7 and 8). The above procedure also applies to the 20 hour flyback limit category shown in Figure 601 (Sheet 9) the above procedure does not apply to normal blending.

(5) Shingled blades (blades whose mid-span shrouds have overlapped due to heavy foreign object ingestion) must be unshingled and may be continued in service for maximum of 20 hours if following conditions are met:

(a) Shingled blades must be unshingled without further damage.

(b) Visual inspection must confirm that mid-span shroud of shingled blade has not hit airfoil of adjacent blade or radius between airfoil and mid-span shroud of adjacent blade. Blades showing evidence of having been hit in this manner must be removed from service before further flight.

(c) After the 20-hour limit, it is necessary to remove shingled compressor blades and examine them for damage, cracks, and airfoil displacement (bow) as specified in the JT8D Engine Manual.

Task 72-00-00-210-007:

7. First Stage Compressor Blade Mid-Span Shroud Repair Limits See Figure 601 (Sheet 10).

A. Scattered pits in 1st stage compressor blade mid-span shroud radius up to maximum depth of 0.017 inch may be removed by blending providing airfoil thickness is not reduced. Blending is to be confined to concave side of mid-span shroud radius in leading edge area only as indicated by radius denoted on the figure.

NOTE: For Post SB6072 JT8D-15A,-17A, and -17AR engines: In an assembled rotor, these blades will have a loose fit between adjacent midspan shroud faces. This is a normal and acceptable condition for these blades.

B. Erosion is acceptable in the same area provided radius is lightly stoned to a maximum depth of 0.017 inches.

C. Original 0.234 - 0.266 inch radius and rounded edges should be maintained after blending.

Task 72-00-00-210-008:

8. Second Stage Compressor Blade F.O.D. And Continue-In-Service Limits

See Figure 602 (Sheets 1 through 5).

A. General

NOTE: After any F.O.D., either repaired or non-repaired, all limits are valid only if continued use of damaged blades does not cause excessive imbalance or vibration during engine operation. Use of such blades could adversely affect compressor efficiency and engine performance.

B. Specific Limits For Non-Repaired F.O.D.

(1) Blades with small tears, as defined in Figure 602 (Sheet 1), may be continued-in-service provided that they are visually inspected at 500 hour intervals. Any crack indication exceeding 0.250 inch is cause for blade removal or repair.

C. Repair Limits

(1) Second stage compressor blades with damage above blade platform should be blended per Figure 602 (Sheet 2) and as follows:

NOTE: No axial (parallel to chord) polishing or blending indications are allowed at any location on blade airfoil.

(a) Blending may be done locally or along full length of leading edge, trailing edge, and side shown in figure for JT8D-1,-1A,-1B,-7,-7A,-7B and on all four sides for JT8D-9,-9A,-11,-15,-15A,-17,-17A,-17R and -17AR within limits shown except where otherwise shown. Blended blades must have airfoil and upper platform area glass-bead peened at next blade overhaul.

(2) Second stage compressor blades with damage below blade platform should be blended as shown in Figure 602.

(a) In Area A (Index 2 on Sheet 4 of figure) blend all local damage up to 0.030 inch deep maintaining 0.030 inch minimum leading edge wall thickness. Blends should have a minimum of 0.050 inch radius. Avoid excessive material removal. See figure.

(b) No more than 0.010 inch deep maximum pitting is allowed in fillet radius (Area K) (Sheet 3 of figure). Blending is not permitted in fillet radius.

Task 72-00-00-210-009:

9. Sixth And Seventh Stage Compressor Blade Borescope Inspection

A. Procedure
See Figures 604, 605, 606, and 608.

WARNING: DO BORESCOPE INSPECTION IN AN AREA WHICH HAS PROTECTION FROM THE WEATHER. IF A BORESCOPE INSPECTION IS DONE IN WET CONDITIONS, USE SUFFICIENT PROTECTION TO PREVENT DAMAGE TO EQUIPMENT OR POSSIBLE ELECTRICAL SHOCK TO THE OPERATOR.

CAUTION: ALLOW COOL-DOWN PERIOD ON NEWLY SHUT DOWN ENGINE PRIOR TO INSPECTION TO ENSURE THAT PERSONNEL ARE NOT INJURED AND EQUIPMENT IS NOT DAMAGED.

(1) Allow approximately two hours after engine shutdown before beginning borescope inspection when outside temperature is approximately 75°F (24°C); allow approximately two and a half hours if outside temperature is above 80°F (27°C), and allow approximately one hour if temperature is 30°F (-1°C) or lower. Rate of cool-down can be increased by motoring engine after shutdown with starter for 30 second periods.

(2) For engines so equipped, remove lockwire and borescope plug from locations shown in Figure 604, 605, and 606.

NOTE: See Task 72-00-00-210-003 for general borescope information.

(3) Inspect condition of 6th stage and 7th stage blade leading and trailing edges.

(a) Sixth stage blade damage must not exceed limits shown in Figure 609.

(b) Seventh stage blade damage must not be more than the limits shown in Figure 610.

(c) If blade damage exceeds limits given, engine must be removed and disassembled for compressor repair.

(d) Check for tablock integrity and any blade root crack indications. If tablocks are missing and/or cracks are noted in blade roots, engine must be removed for repair.

(4) Inspect edges of all borescope holes in fan duct, inter- mediate case, fifth stage outer duct, and sixth stage stator for cracks.

(5) Install borescope plug and torque to 22 - 24 lb-in..

NOTE: Prior to installing PN 510101 Plug, inspect for length of threaded area. If thread is between 0.345 to 0.365 inch long, machine plug to achieve dimensions shown in referenced figure.

(6) Lockwire plug to bracket.

Task 72-00-00-210-010:

10. Sixth Through Tenth Stage Blade Inspection (Optional For Engines Not Equipped With Borescope Holes)

A. Procedure
See Figures 608 through 614.

WARNING: DO BORESCOPE INSPECTION IN AN AREA WHICH HAS PROTECTION FROM THE WEATHER. IF A BORESCOPE INSPECTION IS DONE IN WET CONDITIONS, USE SUFFICIENT PROTECTION TO PREVENT DAMAGE TO EQUIPMENT OR POSSIBLE ELECTRICAL SHOCK TO THE OPERATOR.

CAUTION: ALLOW COOL-DOWN PERIOD ON NEWLY SHUT-DOWN ENGINE PRIOR TO INSPECTION TO ENSURE THAT PERSONNEL ARE NOT INJURED AND EQUIPMENT IS NOT DAMAGED.

(1) Allow approximately two hours after engine shutdown before beginning borescope inspection when outside temperature is approximately 75°F (24°C); allow

approximately two and a half hours if outside temperature is above 80°F (27°C), and allow approximately one hour if temperature is 30°F (-1°C) or lower. Rate of cool-down can be increased by motoring engine after shutdown with starter for 30 second periods.

(2) Remove forward low pressure transfer tube (see Task 72-70-00-430-001, Maintenance Practices-00) for access and insert flexible borescope through bleed port and nearest airhole in 7th stage stator wall. Extend borescope forward along gaspath until tip is in favorable position to observe rear of 6th stage disk and blades, see Figure 608.

(3) Inspect 6th stage blades while an assistant slowly rotates N1 rotor.

CAUTION: THE FACT THAT NO CRACKS ARE NOTED AT REAR OF BLADE ROOT DOES NOT GUARANTEE THAT REST OF ROOT AREA WILL BE FREE OF CRACKS.

(a) Sixth stage blade damage must not be more than the limits shown in Figure 609.

(b) Check for tablock integrity and any blade root crack indications. If tablocks are missing and/or cracks are noted in blade roots, engine must be removed for repair.

(4) Reposition borescope to permit observation of 7th stage disk and blades. Blade leading and trailing edge damage must not exceed limits in Figure 610. If damage exceeds limits given, engine must be removed for repair.

(5) It is possible to do a borescope inspection of the 8th, 9th and 10th stage compressor blades only on post ASB 5649 or ASB 6038 engines. These engines have borescope access holes drilled in the outer compressor shrouds. See Figure 604. Do the borescope inspection as follows:

(a) Install a flexible borescope through the hole in the 7th stage compressor stator. Examine the 8th stage blades while an assistant slowly rotates the N2 rotor. The 8th stage blade damage must not be more than the limits shown in Figure 611.

(b) Remove the borescope from the 7th stage stator and install it through the hole in the 8th stage compressor stator. Examine the 9th stage blades while an assistant slowly rotates the N2 rotor. The 9th stage blade damage must not be more than the limits shown in Figure 612.

(c) Remove the borescope from the 8th stage stator and install it through the hole in the 9th stage compressor stator. Examine the 10th stage blades while an assistant slowly rotates the N2 rotor. The 10th stage blade damage must not be more than the limits shown in Figure 613.

(d) If any blade is damaged more than the limits shown in the appropriate figure, it will be necessary to remove the engine for repair.

(6) When the borescope check is completed, remove the borescope. Install the bleed port transfer tube by, 72-70-00, Maintenance Practices-00 (Task 72-70-00-430-001).

Task 72-00-00-210-011:

11. Eighth Stage Stator Shroud Crack Inspection

A. Inspect the 8th stage stator shroud for cracks to the limits shown. Stators with cracks that fall within the limits shown must be inspected again to the schedule shown:

(1) Stators with more than 10,000 cycles: Inspect cracks every 250 flight hours.

(2) Stators with less than 10,000 cycles: Inspect cracks every 500 flight hours.

B. Crack Limits

(1) The total length of any crack must not be more than 1.000 inch.

(2) No more than two cracks are allowed.

(3) If two cracks are identified, they must be 60 degrees apart minimum circumferentially.

(4) No intersecting cracks are allowed.

(5) No cracks that separate into two directions are allowed.

NOTE: Cracks more than the limits shown is not acceptable and requires that the stator be repaired to the engine manual within 50 flight hours.

Task 72-00-00-210-012:

12. Twelfth and Thirteenth Stage Blade Inspection

A. Procedure
See Figure 614.

WARNING: DO BORESCOPE INSPECTION IN AN AREA WHICH HAS PROTECTION FROM THE WEATHER. IF A BORESCOPE INSPECTION IS DONE IN WET CONDITIONS, USE SUFFICIENT PROTECTION TO PREVENT DAMAGE TO EQUIPMENT OR POSSIBLE ELECTRICAL SHOCK TO THE OPERATOR.

CAUTION: ALLOW COOL-DOWN PERIOD ON NEWLY SHUT-DOWN ENGINE PRIOR TO INSPECTION TO ENSURE THAT PERSONNEL ARE NOT INJURED AND EQUIPMENT IS NOT DAMAGED. ENGINE - INSPECTION/CHECK

(1) Allow approximately two hours after engine shutdown before beginning borescope inspection when outside temperature is approximately 75°F (24°C); allow approximately two and a half hours if outside temperature is above 80°F (27°C), and allow approximately one hour if temperature is 30°F (-1°C) or lower. Rate of cool-down can be increased by motoring engine after shutdown with starter for 30 second periods.

(2) This inspection requires a flexible borescope. It is recommended the borescope is not more than 6MM in diameter.

(3) Remove the most accessible igniter plug by section 74-22-01, Removal/Installation.

NOTE: See Task 72-00-00-210-003 for general borescope information.

(4) Insert the borescope through the igniter plug hole in the combustion section fan duct and combustion chamber outer case.

(5) After the borescope goes through the combustion chamber outer case, do not continue into the combustion chamber can. Manipulate the scope forward along the gaspath inner wall of the combustion chamber outer case and the diffuser case until the borescope reaches the high pressure compressor exit stator vanes and the 13th stage blades.

(6) Rotate the starter drive to rotate the high pressure compressor rotor and view each 12th and 13th stage blade.

(7) 12th and 13th stage blade damage must not exceed the limits shown in Figure 614.

(8) If any blade damage exceeds the limits shown in Figure 614, it will be necessary to remove the engine for repair.

(9) When the borescope inspection is completed, remove the borescope from the engine.

(10) Install igniter plug by Section 74-22-01, Removal/Installation-00 (Task 74-22-01-450-001).

Task 72-00-00-210-013:

13. Third Stage Turbine Rotor

A. Inspection for 3rd Stage Turbine Blade Shift - General

(1) The following borescope or isotope inspection should be performed on JT8D-1,-1A,-1B,-7,-7A,-7B,-9, and -9A engines incorporating 3rd stage turbine disks PN539003, 540503, 618703, 650403, 746003, 757003, 757103 and 770003 in order to detect axially displaced blades. Borescope or isotope inspection is not required on JT8D-11,-15,-17, or -17R engines.

NOTE: Engines which incorporate SB 4592 (washers under flared ends of 3rd stage turbine blade rivets), regardless of 3rd stage turbine disk part number, do not require this borescope or isotope inspection of 3rd stage turbine rotor. Third stage turbine disks PN623303 and 626603 incorporating deep elliptical rivet PN618749 can also be exempted from borescope or isotope inspection.

(2) Inspect the indicated engines for axial displacement of 3rd stage turbine blade in the disk blade slot by borescope or isotope inspection prior to the accumulation of 3000 hours time in service since blades were installed in disk or within next 600 hours if blades have accumulated more than 3000 hours in disk. Engines with no measurable 3rd stage turbine blade mismatch or displacement must be reinspected every 1000 hours thereafter.

(a) Engines with 3rd stage turbine blade root displaced axially more than 0.032 inch relative to disk rear surface, or engines with 3rd stage turbine blade root platform rear surface displaced axially more than 0.032 inch relative to an adjacent 3rd stage turbine blade root platform rear surface must be removed prior to further flight.

(b) Engines with 3rd stage turbine blade mismatch or axial displacement of 0.032 inch or less shall be subject to 300 hour repetitive displacement inspections. Engines with 3rd stage turbine blade mismatch confirmed by initial displacement inspection and two 300 hour repetitive displacement inspections during which there is no change in blade position, indicating that blades were mismatched at assembly, may then revert to 1000 hour repetitive inspection interval.

NOTE: A piece of 0.032 inch safety wire may be used with borescope technique as guide to determine position of blade relative to disk rear face or blade root platform rear surface relative to adjacent blade root platform rear surface.

B. Borescope Inspection

WARNING: DO BORESCOPE INSPECTION IN AN AREA WHICH HAS PROTECTION FROM THE WEATHER. IF A BORESCOPE INSPECTION IS DONE IN WET CONDITIONS, USE SUFFICIENT PROTECTION TO PREVENT DAMAGE TO EQUIPMENT OR POSSIBLE ELECTRICAL SHOCK TO THE OPERATOR.

CAUTION: ALLOW COOL-DOWN PERIOD ON NEWLY SHUT-DOWN ENGINE PRIOR TO INSPECTION TO ENSURE THAT

PERSONNEL ARE NOT INJURED AND EQUIPMENT IS NOT DAMAGED.

(1) Allow approximately two hours after engine shutdown before beginning borescope inspection when outside temperature is approximately 75°F (24°C); allow approximately two and a half hours if outside temperature is above 80°F (27°C), and allow approximately one hour if temperature is 30°F (-1°C) or lower. Rate of cool-down can be increased by motoring engine after shutdown with starter for 30 second periods.

(2) To perform this borescope inspection the following equipment is required:

NOTE: See Task 72-00-00-210-003 for general borescope information.

(a) Rigid lighted borescope such as ACM1 Model No. BFO-1816A or equivalent, or flexible lighted borescope such as Olympus IF Model No. 8S1-10 or equivalent.

(b) Light supply (120 volt or greater) such as Wappler ACM1 1020 high-intensity fiber illumination or equivalent, or Olympus Model No. 1K Type H150E (for flexible borescope) or equivalent.

(3) Perform borescope inspection for axially displaced 3rd stage turbine blades as follows:

(a) Index mark 4th stage blades for reference to ensure that 3rd stage rotor is inspected through complete 360 degrees.

(b) Insert probe forward into engine gaspath from exhaust area between any two pairs of 4th stage turbine blades and vanes.

(c) Inspect using one of the following methods, as applicable:

1 Flexible borescope: align borescope to provide view of rear face of 3rd stage turbine disk in blade slot area (this view will show rear surface of 3rd stage turbine blade roots). Inspect visible 3rd stage turbine blade roots for rearward displacement with respect to adjacent rear surface of 3rd stage turbine disk.

2 Rigid borescope: align borescope to provide view of 3rd stage turbine blade rear platforms. Inspect each visible 3rd stage turbine blade rear platform for rearward displacement with respect to adjacent blade rear platforms.

(d) Withdraw borescope from turbine rotor, rotate rotor as required to bring additional 3rd stage turbine blades into view, then insert borescope and continue inspection.

(e) Repeat step (d) until 3rd stage turbine rotor has been inspected through 360 degrees. Visible axial displacement of any 3rd stage turbine blade shall be cause for rejection of 3rd stage turbine rotor.

(4) If rotor is rejected, based on above inspection procedure, engine shall be removed and 3rd stage turbine disk and blade assembly shall be removed and debladed, and blades shall be inspected and repaired.

C. Isotope Inspection (Optional to Borescope)
See Figure 615.

(1) This inspection procedure consists of making a cross-sectional "photograph" of the 3rd stage turbine rotor using film exposed outside the engine to a radiation source placed inside the turbine rotor.

(2) To perform this isotope inspection the following equipment is required:

(a) 100 curie radiation source, Iridium 192 in Model 660 Gamma Ray Projector, available from Technical Operations, Inc., Burlington, Mass.

(b) Flexible guide tube, available from Technical Operations, Inc., Burlington, Mass.

(c) Three-piece source positioning rod with 3/8-inch diameter, 6-inch tip, available from Technical Operations, Inc., Burlington, Mass.

(d) Radiographic film, 14 by 17 inch Type AA, available from Eastman Kodak Company, Rochester, New York.

(e) Flexible film cassettes, 12 by 17 inch and 14 by 17 inch, with 0.010 inch lead screens.

(f) Film paddles for 12 by 17 inch and 14 by 17 inch film.

(g) Lead numbers and letters.

(h) Masking Tape.

(i) Timer.

(j) Ten-foot tape measure.

(k) Centering adapter for source positioning rod.

(l) Radiation safety equipment.

(m) Automatic film processor.

(n) Film viewing equipment.

(3) Remove front accessory support assembly by Section 72-21-00, Maintenance Practices-00.

(4) Remove front accessory gearshaft retaining ring and remove gearshaft using PWA 12292 Puller. Remove plug from inside of front hub using PWA 12402 Wrench.

(5) Boeing 727/737 engine: prepare four 12 by 17 inch and five 14 by 17 inch flexible film cassettes incorporating two 0.010 inch lead screens.

(6) Douglas DC-9 engine: prepare three 12 by 17 inch and seven 14 by 17 flexible film cassettes incorporating two 0.010 inch lead screens.

NOTE: Douglas airframe installations employ components in fan bypass stream which require repositioning of film and additional exposure steps.

(7) Install appropriate size Type AA film and mount film cassettes on appropriate size film positioning paddles.

(8) Using lead numbers and letters, identify film cassettes from one through nine (Boeing 727/737) or one through ten (Douglas DC-9), counting clockwise as seen from the rear, starting at the top.

NOTE: Additional identification markings on film such as aircraft and engine serial number, engine position, date, description, etc., may also be added.

(9) Insert film positioning paddles into fan bypass inside fan exhaust outer duct so that rear edge of film is slightly forward of fan exhaust outer duct struts, and with each film cassette overlapping the adjacent cassette on each side by one inch. See Figure 615.

(10) Attach locally fabricated holding fixture to front of No. 1 bearing housing.

(11) Assemble source positioning equipment, using only one section of flexible guide tube.

WARNING: TAKE ALL POSSIBLE SAFETY PRECAUTIONS APPROPRIATE TO HANDLING OF RADIOACTIVE MATERIAL.

(12) Insert source positioning rod through front compressor front hub and extend rod rearward into No. 4 1/2 and 6 bearing shield and tube assembly, until rod end is 97 1/8 inches from No. 1 bearing housing front flange.

(13) Expose film for 180 curie-minutes.

(14) On Douglas DC-9 engine, make first exposure with film arranged as shown in figure, then accomplish the following:

(a) Temporarily mark 4th stage turbine blade at 3 o'clock position at time first exposure was made.

(b) After first film exposure, set two more film cassettes for second exposure as shown in figure. Turn rotor 45 degrees in direction shown, using marked blade for reference.

(c) Make second exposure.

(15) Develop film, using automatic film processor.

(16) Any film evidence of 3rd stage turbine blade shift is cause for engine removal.

(17) Remove all inspection equipment.

(18) Install front compressor plug with new packing lubricated with a thin layer of PWA 36500 Assembly Fluid. Tighten the plug handtight with PWA 12402 Wrench.

(19) Install front accessory gearshaft and secure retaining ring.

(20) Install front accessory support assembly by Section 72-21-00, Maintenance Practices-00.

Task 72-00-00-210-014:

14. Combustion Chamber

A. Borescope Inspection
See Figure 616.

WARNING: DO BORESCOPE INSPECTION IN AN AREA WHICH HAS PROTECTION FROM THE WEATHER. IF A BORESCOPE INSPECTION IS DONE IN WET CONDITIONS, USE SUFFICIENT PROTECTION TO PREVENT DAMAGE TO EQUIPMENT OR POSSIBLE ELECTRICAL SHOCK TO THE OPERATOR.

(1) General

(a) This inspection procedure is designed to detect damage or distress to combustion chambers and surrounding structures by means of flexible fiberoptic borescope. Using equipment specified in this procedure, it is possible to make thorough examination of internal surfaces of each combustion chamber. In addition, adjacent structures such as fuel nozzles, inner and outer outlet ducts, and 1st stage turbine vanes and blades may be viewed and inspected.

NOTE: See Task 72-00-00-210-003 for general borescope information.

(b) Inspection personnel performing borescope inspection of combustion chamber liners must have completed borescope training according to one of the following:

1 Inspector must have completed prescribed JT8D combustion chamber liner borescope training at Pratt & Whitney Customer Training Center and must have completed training in inspection of two sets of combustion chambers installed in engines at operator or overhaul agency facility before beginning service inspections of operational engines. OR

2 Inspector must have completed Pratt & Whitney approved training session conducted by instructor trained at Pratt & Whitney Customer Training Center and must have completed training in inspection of two sets of combustion chambers installed in engines at operator or overhaul agency facility before beginning service inspections of operational engines.

(c) This procedure depicts the use of the following equipment:

NOTE: Equipment listed below is available as kit from Olympus Corporation IFD, 4 Nevada Drive, Lake Success, NY 11042-1179. Kit including light source is Model No. OCK-JT8D-C1 (Catalog No. 1227D). Kit without light source but with adapter allowing connection to Wolf or ACMI high-intensity light source is Model No. OCK-JT8D-C2 (Catalog No. 1227E).

1 Flexible Fiberscope Model IF6D3-20, 6mm diameter by 2 meter length.

NOTE: Side-viewing (90-degree) borescope tip, Model IF6D3-A65S is available if required and is recommended for accomplishing complete inspection of combustion chamber crossover tube areas.

2 ILV 300 watt Xenon Light Source.

3 Articulating support arm.

4 GT-JT8D Articulating Guide Tube, 11mm diameter by approximately 50 inch length.

5 Friction Plate (to be attached to external fan duct ignition boss, with central hole permitting close, stabilizing fit around guide tube during borescope maneuvers).

(d) Alternate Olympus Kit is Kit No. MOD OCK-JT8D-C1/4, consisting of the following. Kit No. MOD OCK-JT8D-C2/4 contains Items 1 through 3 but does not include light source.

1 Flexible Fiberscope Model IF8D3X2-20, 8mm diameter by 2 meter length.

2 GT-JT8D/8X4 Articulating Guide Tube with four-way articulation and including friction plate with integral support arm mounting boss.

3 Articulating support arm.

4 Model KLS-2250 High Intensity Light Source (250 watt with improved focus feature).

NOTE: Adapters for adapting Olympus flexible fiberscope to other light sources are available on request from Olympus Corporation.

(e) Also available is similar kit from American ACMI, P.O. Box 1971, Stamford, CT 06904, U.S.A. Kit with 110V high intensity light source is Kit No. BK-JT8D-1; kit with 220V high intensity light source is Kit No. BK-JT8D-1A; kit with borescope, guide tube, friction plate and support arm but without light source is Kit No. BK-JT8D-2.

1 Flexible Borescope BFM-2270DDX

2 FGT-JT8D Four-way Flexible Guide Tube

3 SA-1 Support Arm

4 FCB-1020S (FCB-102A if 220V) High Intensity Light Source

5 Friction Plate (to be attached to external fan duct ignition boss, with central hole permitting close, stabilizing fit around guide tube during borescope maneuvers).

(f) Also available is similar kit from Machida (Machida America, 40 Ramland Road, Orangeburg, NY 10962 U.S.A.). Kit with borescope, guide tube, accessories and support arm is Kit No. MJ072000MA from Machida America; Kit with borescope, guide tube, accessories and extension arm with separate clamps for PRBC and P&D valve is Kit No. MJ072000 from Machida Japan. RG-400 high intensity light source must be ordered separately. Kit details are as follows:

1 Flexible Borescope FB7-2000A

2 GT12-1500 Guide Tube

3 SAH-10000MA Accessory Kit (FD-8D, FP-8D-200 Friction Plates, SH-8D Scope Holder)

4 MA0030 Support Arm and Clamp (Machida America Kit)

5 EA-8D Extension Arm (Machida Japan Kit)

6 CP-8D-PC PRBC Clamp (Machida Japan Kit)

7 CP-8D-DV P&D Valve Clamp (Machida Japan Kit)

NOTE: Borescope equipment other than that specified may be substituted provided no loss of effectiveness results. Operators wishing to use alternate Olympus, ACMI, or Machida products or products of other manufacturers should request approval from Customer Support Department, Pratt Whitney Division of United Technologies Corporation, East Hartford, CT 06108, U.S.A.

(g) Alternate Machida Kit is Borescope Set MA 11180W, consisting of 11 mm borescope with two planes of articulation on borescope sheath, allowing maneuvering of borescope without guide. Also featured is simultaneous straight ahead and 90 degree viewing. Light source RG-400 is available separately. Kit details are as follows:

1 Flexible Borescope FBA-11-180W.

2 SAH-1100 Accessory Kit (MA0030 Support Arm And Clamp, MA0040 Borescope Holder, FP-8D, FP-8D-200 Friction Plates).

(h) An alternative source is the Welch Allyn Video Probe 2000 system. This equipment has a flexible borescope (Flying Probe PN VS215S) which uses air pressure from the distal tip to move the probe through the engine. A friction plate and support arm at the outside of the engine are not necessary with this system.

Send for information to:

Welch Allyn
Inspection Systems Division
4619 Jordan Road
P.O. Box 100
Skaneateles Falls, NY 13153-0100

Welch Allyn Gmbh
Taunusstrasse 12
6238 Wallau, Germany

Welch Allyn (H.K.) Inc.
7/F Kam Ping Building
95 King's Road
North Point, Hong Kong

(i) Make record of inspection findings by plotting indications and observed damage of each individual combustion chamber on individual copies of worksheet shown in Sheet 1 of figure. Note that dimensions of internal features of combustion chamber are presented, to aid in accurately estimating crack length and size and relative shape of damaged area. See Sheet 2 of figure for

definitions of internal and external features of combustion chamber.

NOTE: It is recommended that sample combustion chamber or photos of good quality be available to inspector when engine is being borescope inspected. Spare chamber or photos will provide ready reference to inspector and will assist in identifying exact position of distress, should it be present. Sheet 1 of figure illustrates post SB No. 5192 chamber.

(j) Retain copy of individual combustion chamber liner inspection plots to aid in detecting progression of existing cracks or damage, or in evaluating appearance of new cracks or damage when future inspection is accomplished.

(k) Compare plotted inspection findings to limits in ASB 5639 to determine serviceability of combustion chambers.

(2) Procedure

CAUTION: ALLOW COOL-DOWN PERIOD ON NEWLY SHUT-DOWN ENGINE PRIOR TO INSPECTION TO ENSURE THAT PERSONNEL ARE NOT INJURED AND EQUIPMENT IS NOT DAMAGED.

(a) Allow approximately two hours after engine shutdown before beginning borescope inspection when outside temperature is approximately 75°F (24°C); allow approximately two and a half hours if outside temperature is above 80°F (27°C), and allow approximately one hour if temperature is 30°F (-1°C) or lower. Rate of cool-down can be increased by motoring engine after shutdown with starter for 30 second periods.

WARNING: DO NOT ATTEMPT TO PERFORM HAND CHECK OF FAN DUCT TEMPERATURE SOONER THAN ONE HOUR AFTER SHUTDOWN (TIME INTERVAL MAY VARY IF STARTER MOTORING IS USED).

(b) Alternate method of determining whether or not engine has cooled sufficiently for borescope inspection of combustion area consists of placing palm of bare hand on combustion chamber

and turbine fan duct; when hand can be held comfortably against duct, engine is cool enough to permit inspection.

(c) Remove igniter plugs per Chapter/Section 74-22-01, Removal/Installation-00.

(d) Attach friction plate to igniter boss on combustion chamber and turbine fan duct.

NOTE: Inspection may begin at either right or left side of engine provided all combustion chambers receive full inspection.

(e) Set up borescope equipment as follows:

CAUTION: DO NOT ATTACH SUPPORT ARM OR OTHER HOLDING DEVICES TO TUBES OR TO OTHER THIN-WALLED OR HIGHLY FINISHED STRUCTURES. SELECT ATTACHING POINT ON ENGINE WHICH WILL WITHSTAND CLAMPING FORCE AS WELL AS BENDING LOADS DURING SUBSEQUENT BORESCOPE MANEUVERS.

1 Attach support arm to secure location on engine to provide convenient mounting point for articulation control block on guide tube. Use pressure ratio bleed control housing as attachment point when using engine right side igniter boss (No. 4 combustion chamber access). Use pressurizing and dump valve housing as attachment point when using engine left side igniter boss (No. 7 combustion chamber access).

2 Secure articulation control block on guide tube to support arm and position block close enough to engine to permit maximum guide tube insertion into engine.

CAUTION: ENSURE THAT SHIELD ON TIP OF DIRECT-VIEWING BORESCOPE IS SECURELY THREADED IN PLACE.

CAUTION: DO NOT LOOP OR COIL BORESCOPE IN TIGHT BENDS WHICH MIGHT DAMAGE FIBER OPTICS. SEE MANUFACTURER'S RECOMMENDATIONS FOR SAFE HANDLING.

3 Fit borescope with direct-viewing tip.

4 Insert borescope into guide tube and position eyepiece unit above guide tube control block in comfortable viewing position. See Sheet 3 of figure.

NOTE: To provide maximum maneuverability both guide tube and borescope are articulated. Position articulation controls on guide tube block and on borescope eyepiece unit in comfortable and convenient position.

5 Connect borescope to light source and turn on light source.

(f) Rotate and position guide tube and borescope with respect to operator and to each other so that "Up" and "Down" articulation using guide tube and borescope control knobs produces motion in same plane rather than at angle to each other. If guide tube and/or borescope features four-way articulation, determine which anticulation knobs produce up and down motion.

(g) Arrange borescope eyepiece unit and guide tube control block so that control knobs of each unit are positioned approximately at right angles to each other.

NOTE: Positioning of control knobs as described above (for Olympus equipment) ensures that borescope and guide tube articulation will be in same plane.

(h) For Machida and Olympus systems, look into eyepiece reticle and locate triangular mark in borescope sight picture. Ensure that this mark is at 12 o'clock position so that it will be possible to establish orientation of plane of borescope tip articulation. Reticle locates plane of articulation; reticle positioned at 12 or 6 o'clock position indicates vertical tip articulation, and reticle at 3 or 9 o'clock position indicates horizontal tip articulation. For ACMI system, reticle is located 90 degrees from plane of articulation.

(i) Make note of relative location at borescope tip of light and optic openings; it will be advisable during inspection procedure to position optic side of borescope tip closer than light side to combustion chamber surfaces.

NOTE: With borescope in proper up and down orientation, tip viewing lens is at upper side of tip, in line with triangular mark in eyepiece view. See (Sheet 4) of figure.

(j) With borescope retracted as indicated by "Marker 1", and with all articulation controls in neutral (straight) position, insert guide tube and borescope through hole in friction plate. Ensure that borescope and guide tube will respond to "Up" and "Down" articulation in vertical plane; articulation in vertical plane is most desirable for beginning insertion into combustion chamber.

NOTE: Friction plate is fitted with rubber seal to hold guide tube in selected position. If guide tube binds or is difficult to insert, it is permissible to lubricate guide tube lightly with petrolatum.

(k) Check progress of borescope through eyepiece while inserting borescope and guide tube; borescope should protrude from guide tube sufficiently to permit full effectiveness of viewing tip and light beam.

(l) As soon as possible after entering combustion chamber, establish orientation of borescope inside chamber. If borescope is inserted through left-side igniter plug port (No. 7 combustion chamber), fuel nozzle should be seen at left, or 9 o'clock position. View through combustion chamber toward turbine vanes should be seen at right, or 3 o'clock position. For right-side igniter plug port (No. 4 combustion chamber), this orientation should be reversed. Articulate guide tube tip to align borescope with combustion chamber liner crossover tube port.

(m) If next combustion chamber to be entered is above first (No. 4 or No. 7) combustion chamber, articulate guide tube upward, verifying movement through eyepiece. If next combustion chamber is below first, articulate guide tube downward. Use articulation and twisting of guide tube to line up borescope with crossover tube.

(n) Extend borescope from guide tube while checking view through eyepiece to ensure that borescope is passing through crossover tube into next combustion chamber.

(o) Feed guide tube into engine through friction plate, simultaneously retracting borescope to prevent borescope from being extended too far into next combustion chamber.

(p) Extend guide tube and borescope through as many combustion chambers as desired before beginning detailed inspection. Borescope may be inserted through as many as four combustion chambers and permit complete chamber inspection; up to this number, borescope will have sufficient length to extend rearward through combustion chamber to view entire interior of chamber, as well as fuel nozzle, inner and outer outlet ducts and 1st stage turbine vanes and blades.

NOTE: It is recommended that borescope and guide tube be extended through maximum of four combustion chambers, with inspection beginning at farthest combustion chamber liner first. Borescope should be withdrawn to next combustion chamber in sequence as inspection progresses.

(q) See Sheet 5 of figure for typical inspection sequence. Borescope may be turned and directed rearward inside combustion chamber by twisting guide tube; when borescope and guide tube are turned so that they can be articulated to point rearward, extend borescope through guide tube and inspect features shown in Sheet 6 of figure.

(r) Begin inspection of interior of combustion chamber at rear liner of chamber. Articulate guide tube and borescope so that view forward toward fuel nozzle is obtained. Scan interior of combustion chamber by gently twisting guide tube (close to friction plate) so that tip of borescope moves around inner circumference of chamber (see Sheet 6 of figure).

NOTE: If difficulty is experienced obtaining full, 360-degree view of chamber interior, view those areas not covered by rotating borescope from rear as in step (p) by moving borescope axially forward and back through chamber interior.

(s) Look forward toward nozzle and scan all of liners and louvers aft of 3rd to 4th liner weld joint to determine whether liners have cracked circumferentially in areas rearward of attaching resistance weld joints. Also look for indication of liner burning and cracking distress forward of resistance weld joints. If distress is noted, inspect area more closely, viewing under louvers for cracking or weld separation. See Sheet 6 of figure.

NOTE: Satisfactory view of area under louvers can be obtained by articulating borescope tip so that tip curves forward against combustion chamber wall with optic side (180 degrees away from light side) toward chamber wall (see Sheet 6 of figure). If light side of tip is closer to chamber wall, full view of louver will not be possible. If this occurs, articulate borescope tip in opposite direction, pull borescope holder toward operator until there is no slack in borescope between guide tube block and borescope holder, then carefully rotate entire borescope handle in

holder 180 degrees repositioning tip of borescope with optic side toward combustion chamber wall.

(t) As borescope is pulled forward through combustion chamber, manipulate tip by twisting guide tube and by using articulation controls of both borescope and guide tube as necessary to view louver area of all combustion chamber liners.

(u) Ensure that louver area can be viewed through borescope all the way forward to attaching weld. If liner distortion has caused bending of inner liner outward toward outer liner so that weld cannot be seen (see Sheet 7 of figure), weld joint must be assumed to be cracked for circumferential length over which weld cannot be seen.

NOTE: Inner liner lip distortion could be result of reduction in cooling air flow or other distress in seam weld or cooling air hole area.

(v) When viewing area under louver and inspecting weld joint area, take into account that outer liner surface between weld and cooling air holes where cracks could appear will be viewed at very shallow angle. Cracking in this area may possibly appear as shiny but rough raised surface (broken edge of liner surface cracked completely through). See Sheet 6 of figure for location of liner features and depiction of liner damage as seen through borescope.

NOTE: Inspector should be alert to need for recognizing crack damage on surfaces viewed at shallow angle. Crack viewed at right angle to surface will appear as hairline or wider separation with space visible between edges but crack viewed at shallow angle in louver area will be visible as displaced surface.

(w) When inspection has proceeded as far forward as crossover tube area, inspect as follows:

1 Point borescope and guide tube radially inward toward center of combustion chamber and scan combustion chamber liner surface between crossover tubes for cracks or damage. Circumferential cracks in this area occur most often proceeding from male crossover tube along 240-degree arc toward female crossover tube.

2 Check under louver at No. 2 to 3 liner and No. 3 to 4 liner seam welds for entire circumference, inspecting liner joint areas in detail for circumferential cracking.

3 Inspect for evidence of combustion chamber shift:

a Turn borescope toward fuel nozzle and check for excessive space between fuel nozzle and combustion chamber nozzle stator.

b Extend borescope part way through crossover tube (preferably through female tube, looking toward male tube) and check for tube eccentricity (male tube farther to rear than female, or the opposite).

c When checking concentricity between male and female tubes, be careful to distinguish between crossover tube and interconnector (see Sheet 6 of figure). Interconnector may be positioned closer to one tube than another at assembly and is not indicator of combustion chamber shift.

(x) Prior to withdrawing borescope and guide tube from combustion chamber and proceeding to next combustion chamber, make thorough inspection of area surrounding crossover tube borescope is passing through, as follows:

1 Articulate guide tube and borescope 180 degrees around as far as possible into U-shape and inspect crossover tube base all around by twisting guide tube. See Sheet 5 of figure, Sequence 4.

2 If difficulty is experienced obtaining full inspection of crossover tube area using technique in step 1, extend guide tube several inches into combustion chamber, then carefully withdraw borescope from guide tube (set articulation controls for borescope and guide tube in straight-ahead position before withdrawing bore- scope). Install 90 degree side-viewing tip on borescope, being careful to align installation marks on tip and borescope sleeve. Reinsert borescope through guide tube and articulate borescope only, to view directly back at crossover tube area through which borescope has passed. Pull borescope holder toward operator to remove all slack from borescope between guide tube block and borescope holder, then carefully rotate entire borescope handle in holder to obtain view of area around crossover tube.

3 When inspection of crossover tube is complete, withdraw borescope and replace side-viewing tip with direct-viewing tip, then reinsert borescope. Withdraw guide tube and borescope into next combustion chamber.

4 When view through eyepiece confirms that borescope is fully in next combustion chamber, proceed to inspect that combustion chamber in same fashion, extending borescope to rear of chamber and working forward, finishing with thorough inspection of crossover tubes where they join with combustion chamber liner.

(y) When inspection has been completed, remove borescope and guide tube from engine. Remove friction plate from ignition boss on combustion chamber and turbine fan duct.

(z) Install igniter plugs per Chapter/Section 74-22-01, Removal/Installation-00.

B. Radiographic Isotope Inspection Procedure
See Figures 617through 621.

(1) General

ENGINE GENERAL - INSPECTION/CHECK-01

(a) This inspection procedure is designed to detect distress to combustion chambers using radiographs of combustion chamber produced by a radiation source placed inside front compressor drive turbine shaft.

NOTE: Isotope equipment and technique other than that specified may be substituted provided no loss of effectiveness results. Operators wishing to use alternate procedures should request approval from Customer Support Department, Pratt Whitney & Division of United Technologies Corporation, East Hartford, CT 06108, U.S.A.

(b) To perform this isotope inspection, the following equipment is required:

NOTE: Obtain radiographic isotope inspection equipment from Technical Operations, Inc., Radiation Products Division, Northwest Industrial Park, Burlington, MA 01803, U.S.A.

1 Iridium 192 radiation source in Technical Operations Inc. Model 660 Gamma Ray Projector with Model 664 Gamma Ray Control Assembly or equivalent.

2 Rigid source positioning rod, Technical Operations Inc. PN 73401-4 or equivalent.

3 Flexible source tubes, Technical Operations Inc. PN 48907 or equivalent.

4 Kodak Type "M" and Kodak Type "AA" film or equivalent with 0.010 inch lead screens on both sides of film.

5 PWA 47252 Support Plate, for centralizing rigid source positioning rod.

6 PWA 47255 Support Guide Tube, for supporting and centralizing rigid source positioning rod.

7 PWA 47253 and PWA 47254 Film Holder Paddles.

NOTE: Paddles are contoured to combustion chamber outer case and two sizes of paddles are used. For size 11 1/2 x 17 inch, 7 - 8 paddles as necessary are required. For size 6 x 17 inch, 2 paddles are required.

8 High variable intensity film reader, minimum of 450 foot candles at 12 inches from 14 x 17 inch screen. For better film viewing use a reader with intensity of 700 - 1000 foot candles at 12 inch from a 14 x 17 inch screen.

(2) Procedure

(a) Remove front accessory drive group by Reference (3), Chapter/Section 72-21-00, Maintenance Practices-00.

(b) Remove front accessory gearshaft retaining ring and remove gearshaft using PWA 12292 Puller.

(c) Remove No. 1 hub plug from inside of front hub using PWA 12402 Wrench.

(d) Remove igniter plugs by Reference (3), Chapter/Section 74-22-01, Removal/Installation-00.

NOTE: For Method 1 (film placement inside the fan bypass duct): If necessary, any components in the fan bypass duct such as CSD oil cooler should be removed. For Method 2 (film placement outside the fan bypass duct): Remove all brackets that interfere with placement of the film between "J" and "J-1" flanges.

(e) Assemble PWA 47252 Support Plate and PWA 47255 Support Guide Tube to rigid source positioning rod as shown. See Figure 617.

(f) When inserting assembly, PWA 47255 Support Guide Tube will slide through turbine shaft coupling lock. Position PWA 47252 Support Plate on No. 1 bearing front support so that wing nut bolts can be inserted at 10 o'clock and 4 o'clock positions. Fingertighten bolts. See Figure 618.

NOTE: Position centerline of source 69 11/16 inches (1770 mm) from aft face of PWA 47252 Support Plate.

(g) Place film as follows: Method 1, film inside the fan bypass duct.

NOTE: Single loading with Size "M" film is permissible, but exposure time will vary from recommended exposure time.

1 Insert appropriate size "M" and "AA" film into cassette, with "M" closest to isotope source.

2 Mount cassette onto appropriate paddle, ensuring that cassette is inserted under front lip on front end of paddle. Using masking tape, secure cassette to paddle.

3 Place lead identification at aft edge of paddle a maximum of two inches (50.8 mm) from any edge. See Figure 620 (Sheet 1), for correct positioning of paddles.

4 Insert paddles into fan exhaust outer duct until leading edge of sleeve on paddle handle is aligned with Flange "M". See Figure 621.

NOTE: For engines that have Ps4 tube at 1 o'clock position, viewed from the rear, butt paddle against this tube.

5 Lock paddle in position by pulling "T" handle rearward until pivot assembly on paddle is wedged between combustion chamber outer case and outer fan duct, and then turn "T" handle clockwise to lock. Lockwire paddle handle to Flange "M" ensuring that handle is parallel to engine centerline.

(h) Place film as follows: Method 2, film outside the fan bypass duct.

1 Cut film by Figure 619.

2 Place lead identification as required.

3 Locate film around engine between Flange "J" and Flange "J-1" by Figures 620 (Sheet 3) and 621.

(i) Expose film as follows:

1 Assemble source position equipment.

WARNING: TAKE ALL POSSIBLE SAFETY PRECAUTIONS APPROPRIATE TO HANDLING OF RADIOACTIVE MATERIAL.

2 Position Iridium 192 source into rigid source position rod.

NOTE: Source must bottom out at end of positioning rod.

3 Expose film as follows for Method 1 film placement. For JT8D-7 models (thin shaft) expose film for 280 curie minutes. For all other JT8D models (thick shaft) expose film for 400 curie minutes. Exposure time should be adjusted to achieve a film density of 2.2 - 3.5, preferable 2.8 - 3.0.

4 Expose film as follows for Method 2 film placement. For all models expose film for 800 curie minutes. Adjust exposure time as necessary to achieve a film density of 2.2 - 3.5, target 2.8 - 3.0.

(j) Remove source from rigid positioning rod.

(k) Remove film from engine.

(l) Develop film in automatic processor.

(m) Analyze film results in dimly lit room with high (variable) intensity film reader. See Figure 621 (Sheet 2) for interpretation of indications as they are observed on film. See ASB 5639 for limits determining effective crack length and appropriate action.

NOTE: All film reading should be accomplished by qualified personnel.

(n) When proper intensity radiographs have been obtained remove all inspection equipment.

(o) Install No. 1 hub plug with new packing coated with PWA 36500 Assembly Fluid. Tighten the plug hand tight with PWA 12402 Wrench.

(p) Install front accessory gearshaft and secure with retaining ring.

(q) Install front accessory support group by Reference (3), Chapter/Section 72-21-00, Maintenance Practices-00.

(r) Install igniter plugs by Chapter/Section 74-22-01, Removal/Installation-00.

NOTE: If necessary, install any parts that were removed from fan bypass duct.

Task 72-00-00-210-015:

15. Oil Level Check, Change, And Strainers

A. Oil Level Check

NOTE: The cylindrical engine oil tank is installed at its aft end on the left front face of the main accessory gearbox. The tank has a self-locking cap with a dipstick gage attached to the cap, and there is a drain valve at the bottom of the tank. The tank also has openings to make it possible to install an aircraft-supplied flight deck oil quantity indicator, optional oil tank sight gages, and an optional oil tank pressure fill system. See Figure 622.

NOTE: The oil tank holds a total of 5.0 U.S. gallons (4.16 Imperial gallons or 18.93 liters). The quantity of oil in the tank that the engine can use is approximately 4 U.S. gallons (3.33 Imperial gallons or 15.14 liters).

NOTE: Refer to SB 238 for approved oils and for procedures that tell how to change to a new oil in an engine.

WARNING: IF TOO MUCH OIL IS ADDED TO THE ENGINE ("OVERSERVICING"), THIS WILL CAUSE HIGHER OIL TEMPERATURES, AND THE ENGINE WILL BLOW THE UNWANTED OIL OUT OF THE BREATHER PORT DURING ENGINE OPERATION. IT IS ALSO POSSIBLE THAT OVERSERVICING OF THE OIL TANK WILL CAUSE SUFFICIENT INTERNAL PRESSURE TO CAUSE AN OIL TANK RUPTURE DURING ENGINE OPERATION.

R CAUTION: DO AN OIL LEVEL CHECK AFTER FIVE MINUTES (BUT
R NOT MORE THAN 30 MINUTES) AFTER ENGINE
R SHUTDOWN. THE FIVE-MINUTE LIMIT IS NECESSARY
R TO LET THE ENGINE ROTORS AND OIL SCAVENGE AND
R PRESSURE PUMPS STOP, TO LET THE ENGINE BECOME
R COOLER, AND TO LET POSSIBLE OIL TANK PRESSURE
R BECOME EQUAL WITH OUTSIDE PRESSURE. ADD
R ENGINE OIL IF NECESSARY. TO HELP TO MONITOR
R OIL CONSUMPTION, RECORD THE OIL QUANTITY
R ADDED. IF THE ENGINE WAS SHUT DOWN FOR MORE THAN 30 MINUTES, THE OIL LEVEL IN THE OIL TANK WILL BE LOWER BECAUSE SOME OF THE OIL WILL DRAIN OUT OF THE OIL TANK THROUGH THE MAIN OIL PUMP AND INTO THE MAIN ACCESSORY GEARBOX. BECAUSE OIL CAN DRAIN OUT OF THE TANK AFTER A LONG TIME, READINGS OF THE OIL LEVEL CAN BE INCORRECT 30 MINUTES OR MORE AFTER SHUTDOWN (THERE WILL BE MORE OIL IN THE ENGINE THAN THE OIL TANK SHOWS).

CAUTION: INTERNAL CLEARANCES IN THE MAIN OIL PUMP CONTROL THE RATE OF OIL FLOW THROUGH THE PUMP. OIL WILL FLOW LESS QUICKLY THROUGH A NEW OIL PUMP (AND THIS WILL CAUSE A LONGER TIME BEFORE THE OIL LEVEL IN THE TANK GETS LOWER). HOWEVER, TO HAVE A PROCEDURE APPLICABLE TO ALL ENGINES, USE THE 30-MINUTE LIMIT.

(1) If the engine was shut down for more than 30 minutes, do these steps before the oil level check. If the

engine was shut down for less than 30 minutes, go to step (2).

(a) Do an oil level check with Method A in step (2) below (use the oil tank cap gage or look in the oil tank filler neck).

(b) If the oil tank is half full or more, start the engine operate it at Idle for one minute minimum with the oil pressure at a constant level (make sure that the oil pressure stays constant for one minute minimum).

CAUTION: TO GET A CORRECT OIL LEVEL PROCEDURE, IT IS NECESSARY TO OPERATE THE ENGINE AT IDLE POWER FOR ONE MINUTE MINIMUM WITH A CONSTANT OIL PRESSURE. IF THERE IS A PROBLEM WITH THE ENGINE'S OIL SCAVENGE SYSTEM (PUMP OR PUMP DRIVE DAMAGE OR INLET SCREEN BLOCKAGE) OR SOME OTHER RELATED SYSTEM PROBLEM, IT IS POSSIBLE THAT THE ENGINE RUN WILL NOT ADJUST THE OIL LEVEL CORRECTLY.

(c) If the oil tank is less than half full, it can be necessary to drain the oil from the main accessory gearbox, fill the oil tank with the correct oil (see SB 238), then operate the engine as specified in step (b) above. This drain and fill procedure will make sure that there is sufficient oil in the engine to operate it, and will also make sure that too much oil is not added to the engine. Drain the main accessory gearbox if:

1 You are not sure that there is sufficient oil in the engine for an engine run. If the oil level was measured 30 minutes or less after the engine was shut down, the oil tank will be one-half full or more. or

2 There will be too much oil in the oil tank if more oil is added to the tank.

NOTE: Record the oil drained from the main accessory gearbox and the oil added to the oil tank (this will make it possible to monitor oil consumption). Measure the oil as accurately as possible and be sure to record the units used (for

example ounces, pints, quarts, or liters).

WARNING: DO NOT LET OIL STAY ON YOUR SKIN. THE SYNTHETIC OIL CONTAINS ADDITIVES THAT CAN BE POISONOUS IF THEY ARE ABSORBED THROUGH THE SKIN. CLEAN AWAY ALL OIL THAT GETS ON THE SKIN.

WARNING: DO NOT RELEASE THE LOCK ON THE OIL TANK CAP UNTIL FIVE MINUTES OR MORE AFTER ENGINE SHUTDOWN. OVERSERVICING OF AN OIL TANK (TOO MUCH OIL ADDED) CAN CAUSE PRESSURE IN THE TANK. THE RESULT OF THIS CAN BE A SPRAY OF HOT OIL WHEN THE CAP IS RELEASED WHICH CAN CAUSE INJURY TO PERSONS OR DAMAGE TO EQUIPMENT. AFTER FIVE MINUTES, PRESSURE IN THE TANK WILL RELEASE INTO THE GEARBOX.

CAUTION: IMMEDIATELY CLEAN AWAY OIL THAT FALLS ON ENGINE OR AIRCRAFT PARTS. THE OIL CAN CAUSE DAMAGE TO PAINT AND RUBBER SURFACES.

(2) Do an oil level check at the oil tank with one of these methods (do the check 30 minutes or less after the engine was shut down after an engine run):

(a) Method A (oil tank gage or visual check (recommended)

1 Lift up the lock handle on the oil tank cap until the lock handle is up. Turn the lock handle approximately 45 degrees counterclockwise until the lock handle aligns with the OPEN mark on the cap. Pull straight up to remove the cap from the oil tank filler neck (see Figure 623).

2 Clean the oil from the cap dipstick with a clean cloth.

3 Make sure that the lock handle is up and is aligned with the OPEN mark on the cap. Install the oil tank cap and engage the three lugs of the cap in the three slots in the oil tank opening. Push down on the cap to compress the packing and then turn the lock handle approximately 45 degrees clockwise to align the handle with the CLOSE mark on the cap (see Figure 624).

4 Turn the lock handle approximately 45 degrees counter- clockwise until the lock handle aligns with the OPEN mark on the cap. Pull the cap straight up to remove it from the tank.

5 Look at the oil level on the dipstick. If the oil tank is full, the oil on the dipstick gage will be at or immediately above the top mark on the gage (the top mark is the second line above the ADD 1 GAL mark on the gage). See Figure 625.

NOTE: It is also possible to look in the oil tank opening for the oil level. If the oil tank is full, the oil level will be at the lower lip of the oil tank cap opening (filler neck). See Figure 626.

(b) Method B (oil tank sight gage) (optional)

1 Look at the oil tank sight gages (See Figure 622). If the oil tank is full, it will be possible to see oil in the lower (forward) sight gage and an oil level line in the upper (aft) sight gage.

CAUTION: ADD OIL ONLY TO THE CORRECT LEVEL. DO NOT ADD TOO MUCH OIL TO THE TANK. IF THERE IS TOO MUCH OIL IN THE TANK, THE ENGINE WILL PUMP IT OVERBOARD.

(3) If necessary add oil to the tank. Use the Manual Fill procedure through the oil tank opening (filler neck) or the optional Pressure Fill procedure that follows, until the oil is at the correct level in the tank. If the oil level check was done by Method B above (with the oil tank sight gages) and you will use the Manual Fill procedure through the oil tank cap opening, you

must remove the oil tank cap with the instructions given in Method A above.

NOTE: Refer to SB 238 for important information about approved engine oils. The SB also tells what to do if different brands of oil are mixed, and how to change to a different brand or type of engine oil.

NOTE: Record the oil added to the oil tank (this will make it possible to monitor oil consumption). Measure the oil as accurately as possible and be sure to record the units used (for example ounces, pints, quarts, or liters). If possible set a standard time after engine shutdown to do oil

NOTE: Level checks on all engines. This standard time will keep to a minimum the oil level differences which are the result of oil that drains into the main accessory gearbox. It is also important not to include external oil leakage during inspections of the engine for bearing compartments which do not seal correctly.

(a) Manual Fill Method

1 Add oil through the oil tank cap opening. The correct oil level is at the lower lip of the opening (filler neck) inside the oil tank. See Figure 626.

(b) Pressure Fill Method (Optional)

1 Remove the protective covers from the two service fittings on the left side of the oil tank (see Figure 622).

2 Attach the pressure and drain lines to the applicable fittings on the oil tank.

3 Slowly fill the oil tank with oil until the oil shows at the center of the upper sight gage, or until oil flows from the drain tube.

4 Remove the pressure and drain lines from the applicable fittings on the oil tank.

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5 Install the protective covers on the two service fittings on the left side of the oil tank.

(4) Examine the oil tank cap packing. If the packing is in good condition, lubricate it lightly with PWA 36500 Assembly Fluid. If necessary replace the packing and lubricate the new packing with PWA 36500 Assembly Fluid.

CAUTION: BE SURE TO INSTALL THE OIL TANK CAP CORRECTLY. IF YOU DO NOT INSTALL THE CAP CORRECTLY, OIL CAN FLOW FROM THE TANK OPENING DURING ENGINE OPERATION, AND THIS CAN CAUSE AN IN-FLIGHT SHUTDOWN. MAKE SURE THAT THE OIL TANK CAP STOPS ARE NOT WORN. IF THERE IS TOO MUCH WEAR ON THE CAP STOPS, THE RESULT CAN BE A LOCK THAT DOES NOT TURN TO THE CORRECT POSITION AND DOES NOT HOLD THE CAP TIGHTLY ON THE OIL TANK FILLER NECK.

(5) Make sure that the lock handle is up and is aligned with the OPEN mark on the cap. See Figure 623. Install the oil tank cap and engage the three lugs of the cap in the slots of the oil tank opening. Push down on the cap to compress the packing and turn the lock handle approximately 45 degrees clockwise. Align the lock handle with the CLOSE mark on the cap. See Figure 624.

(6) To make sure that the lugs are correctly engaged after the cap is installed and the lock handle is turned to the CLOSE position, try to pull up on the cap to remove it, or use a wire hook under the lock handle as shown in Figure 627.

(7) Push the lock handle down to the stowed position. During this handle movement make sure that the machined (smooth) surface of the handle is turned up and away from the cap (make sure that you can see this surface). Make sure that the cast (rough) surface of the cap is turned down (make sure that you cannot see this surface). When in the correct stowed position, the smooth surface of the lock handle is flush with the upper surface of the cap. See Figure 628.

B. Oil Change

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(1) Engine must be operated for at least one minute at idle speed in order that any oil which may be in scavenge section of engine is returned to tank. If drainage takes place immediately after shutdown, it is not necessary to drain any other part of engine in addition to oil tank during oil change. Unlimited lapse of time between shutdown and oil change is permitted providing oil is drained from N2 gearbox, in addition to oil tank.

C. Oil Strainers

CAUTION: WHEN A SMALL AMOUNT OF CONTAMINATION (WHICH IS METAL SHAVINGS, BURRS, HAIR-LIKE PIECES, OR SLUDGE) IS FOUND IN THE OIL STRAINER OR FILTER (WHERE NO DIFFERENTIAL PRESSURE (DELTA P) LIGHT CAME ON), CLEAN OR REPLACE THE STRAINER (175 OR 40 MICRON) OR REPLACE THE FILTER (15/40 MICRON) AND DO AN ENGINE GROUND RUN AT PART POWER FOR SEVERAL MINUTES. ENGINE SHOULD BE ACCELERATED FROM IDLE TO PART POWER SEVERAL TIMES DURING THE RUN. RECHECK STRAINER OR FILTER AND, IF CLEAN, ENGINE IS READY FOR SERVICE. CHECK STRAINER OR FILTER AFTER APPROXIMATELY 50 HOURS OF OPERATION. IF THE STRAINER OR FILTER IS NOT CLEAN, CLEAN OR REPLACE AND REPEAT GROUND RUN AGAIN, THEN REINSPECT. IF IT IS STILL NOT CLEAN, REMOVE ENGINE FOR DETAILED INSPECTION. DETERMINE CAUSE OF CONTAMINATION AND CORRECT AS REQUIRED.

CAUTION: WHEN A LARGE AMOUNT OF CONTAMINATION, CHIPS, OR FLAKES IS FOUND IN THE OIL STRAINER OR FILTER (WHERE NO DIFFERENTIAL PRESSURE (DELTA P) LIGHT CAME ON), DO THE TROUBLESHOOTING PROCEDURE FOR OIL FILTER/STRAINER DIFFERENTIAL PRESSURE (DELTA P) LIGHT ON. REFER TO TROUBLESHOOTING-02 (TASK 72-00-00-810-004).

CAUTION: 40 MICRON STRAINERS OR 15/40 MICRON FILTERS HAVE FINER FILTRATION THAN THE STANDARD 175 MICRON OIL STRAINER AND MAY REACH DIRT HOLDING CAPACITY IN A SHORTER TIME INTERVAL,

THEREFORE IT IS SUGGESTED THAT CONTAMINATION CHECK PERIODS BE ADJUSTED ACCORDINGLY.

(1) It is recommended that oil strainer or filter be removed for inspection at 250 - 400 hour intervals. Refer to 72,61-53, Maintenance Practices-00 (Task 72-61-53-430-001) for procedures to disassemble and examine the filter or strainer.

NOTE: New engines which have recently been put into service occasionally have metal chips reported in the Main Oil Filter or on the Chip Detectors. This is usually caused by manufacturing machining chips. Also, oil sample S.O.A.P. (Spectrometric Oil Analysis Program) readings are sometimes higher than expected in new engines. Normally, these conditions are temporary and should not be cause for engine removal. However, these engines should be monitored to ensure that these conditions improve and return to normal with additional service time.

NOTE: For more information about main oil filter/strainer inspection and for guidance about corrective action, refer to the JT8D Oil Monitoring Guide (PN 821432).

Task 72-00-00-210-016:

16. Fan Inlet Case

A. Vent Plug Strainer Element Inspection and Cleaning
See Figure 629.

NOTE: The fan inlet case vent plug is screwed radially into the inlet case at the six o'clock position. A sleeve type strainer screen prevents dirt particles from blocking the small drain port in the plug.

(1) Inspect vent area at bottom of fan inlet case for evidence of leakage oil draining through vent plug. If leakage is found, check fan inlet case tubing connections.

(2) It is recommended that vent plug and screen be removed, inspected, and cleaned at every 500 hours of engine operation.

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(3) After inspection and cleaning, reinstall and torque vent plug and screen.

B. Outer Shroud Seam Weld Cracking
See Figure 630.

(1) Cases with outer shroud cracking may be continued-in-service provided the following limits are adhered to:

(a) Examine the case for cracks by SPOP 70 (high sensitivity) portable fluorescent penetrant (see Chapter/Section 70-00-00, Standard Practices).

(b) The maximum allows length of any single crack for continued operation is 10.0 inches. The case must be reinspected every 200 hours on a repetitive basis to monitor any crack propagation.

1 If the length of a single crack exceeds 10.0 inches but is less than 15 inches, the case must be removed within 50 hours.

2 If the length of a single crack exceeds 15 inches but is less than 25 inches, the case must be removed within 10 hours.

3 If the length of a single crack exceeds 25 inches, the case must be removed from operation.

(c) For cases with multiple cracks, the maximum allowed total crack length is 30 inches. Cases with total crack length over 30 inches must be removed within 10 hours. The following limits apply to cases with multiple cracks:

1 Cases may continue-in-service with seam weld cracks directly opposite each other on the front and rear flanges (less than 7 inches in circumferential separation), if the cumulative crack length of both cracks is 4 inches or less.

2 Cases may continue-in-service with cracks on either the front, rear, or both flanges up to 4 inches long, if the minimum circumferential separation between cracks is 7 inches.

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3 Cases may continue-in-service with cracks on either front, rear, or both flanges 4 - 10 inches long, if the minimum separation between cracks is 18 inches.

4 Multiple adjacent cracks on the same flange with a circumferential separation of less than 7 inches must be treated as a single crack by adding the crack length and the separation between the cracks. This total length must then be treated as a single crack and must be in the limits given in Step B.

5 Cases with multiple cracks which exceed the limits specified must be removed within 10 hours.

(d) All cracks must be stop drilled using a 0.078 inch drill bit or larger at the end of the crack and at a distance of 1/2 inch beyond the end of the crack.

(e) All cracks must remain tight. They must not exhibit separation or opening.

C. Outer Rear Flange Missing Plasma Coat

NOTE: This inspection/check is only required for inlet cases that have the plasma coat repair applied to the outer rear flange. New inlet cases are not manufactured with plasma coat applied to the outer rear flange.

(1) Inlet cases can continue-in-service with missing plasma coat from the outer rear flange within the limits that follow.

(a) The maximum permitted area of missing plasma coat is 0.060 inch wide by 2 inches long at any one location.

(b) A maximum of five areas of missing plasma coat are permitted around the rear flange.

(c) The minimum distance permitted between any two areas of missing plasma coat is 2.75 inches.

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Task 72-00-00-210-017:

17. Oil Cooler To Pressurizing And Dump Valve Assembly Fuel Tube Assembly

A. At each hot section inspection or shop visit torque the tube nut connection again at the pressurizing and dump valve assembly.

(1) Remove tube nut safety wire.

(2) Torque the tube nut again to 65 - 70 lb-in.

(3) Safety wire tube nut.

Task 72-00-00-210-018:

18. Engine Inspection After Ingestion Of Sand, Dust Or Volcanic Ash

CAUTION: ENGINE INGESTION OF SAND, DUST OR VOLCANIC ASH CAN CAUSE OPERATIONAL PROBLEMS INCLUDING LOSS OF POWER. EVEN IF PROBLEMS ARE NOT EXPERIENCED RIGHT AWAY, SAND, DUST OR ASH CONTAMINATION OF ENGINE SYSTEMS CAN RESULT EVENTUALLY IN PERFORMANCE DETERIORATION, BLOCKED COOLING AIR PASSAGES, AND ABRASIVE DAMAGE.

A. When engine has had moderate exposure to sand, dust or volcanic ash with no subsequent operational problems, perform the following inspections:

(1) Visually check engine inlet and exhaust areas for evidence of damage or excessive erosion.

(2) Borescope inspect rear compressor and 1st stage turbine for evidence of the following:

(a) Excessive erosion.

(b) Foreign object damage (FOD).

(c) Blockage of 1st stage turbine airfoil cooling holes.

(d) Buildup of sand, dust or ash deposits.

(3) Remove oil system chip detectors and examine for indications of engine damage.

(4) Drain, flush, and refill the oil system. Keep an oil sample for analysis.

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(5) Remove and clean or replace all oil, fuel, and air filters/strainers. If contamination is found, keep a sample for analysis.

NOTE: It is strongly recommended that 15-micron main oil filter element be installed if available. If this type of filter is not used, oil change frequency should be increased.

(6) Perform engine ground run to determine if shift in performance parameters has occurred. If parameters are abnormal, engine should be replaced.

B. When engine has experienced operational problems subsequent to sand, dust or volcanic ash exposure, do the following:

(1) Remove the engine and send to a disassembly facility.

NOTE: Engine records shall direct that engines must be disassembled, inspected, and repaired as necessary, paying particular attention to oil system, air-supplied components, and turbine cooling air passages.

Task 72-00-00-210-021:

19. Birdstrike (Foreign Object Damage - FOD) Inspection

A. Equipment And Materials Necessary

(1) Gloves, Plastic Polyethylene or Equivalent

B. Procedure

WARNING: THERE IS A POSSIBLE RISK TO PERSONNEL WHO DO MAINTENANCE TASKS AFTER A BIRD STRIKE. THE SAFETY MEASURES THAT FOLLOW ARE RECOMMENDED.

WARNING: USE DISPOSABLE GLOVES.

WARNING: USE A DISPOSABLE COVERALL IF THERE IS A RISK OF CONTACT WITH BIRD REMAINS WHEN CLEANING.

WARNING: DO NOT USE PRESSURIZED AIR OR WATER TO CLEAN THE PART OF THE ENGINE THAT WAS HIT BY THE BIRD.

WARNING: REMOVE THE BIRD REMAINS AND PUT THEM IN A PLASTIC BAG.

WARNING: DO NOT TOUCH THE FACE, EYES, NOSE, ETC. WITH YOUR GLOVES.

WARNING: REMOVE THE GLOVES AND THE DISPOSABLE COVERALL (IF USED) AND PUT THEM IN THE SAME PLASTIC BAG AS THE REMAINS. SEAL THE BAG.

WARNING: DISCARD THE BAG WITH THE SAME PROCEDURE USED FOR USUAL GARBAGE.

WARNING: CAREFULLY WASH YOUR HANDS WITH SOAP AND WATER.

(1) In the event of a reported or suspected birdstrike, visually examine the inlet area for damage:

NOTE: Signs of a birdstrike can be difficult to find, especially with the passing of time or when weather conditions interfere. Even a small amount of organic material in the inlet is strong evidence of a birdstrike. Bird remains are usually found on the inner surfaces of the rear (concave side) shrouds or low pressure compressor vanes and linkages.

NOTE: Inspection of the inlet area must be guided by pattern of bird remains to find possibly damaged areas. Fan exit guide vanes and low pressure compressor inlet should be checked in addition to the fan blades and inlet cone.

(2) If any or all of the areas below have damage that are in the serviceable limits, but show signs that a bird (object) was ingested through the core engine, do a borescope inspection of the HPC:

(a) Damage to fan blades in area located adjacent to core engine

(b) Bird remains (damage) on compressor inlet vanes

(c) Crew report of bird smell in cockpit, etc.

(d) The incident resulted in a surge followed by abnormal engine parameters.

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Task 72-00-00-210-019:

20. Combustion Chamber And Turbine Fan Duct

A. Rivet Inspection (For engines equipped with optional noise attenuation equipment)

(1) Fan ducts may continue-in-service with loose or missing rivets attaching the inner - shaped brackets to the fan duct providing the following limits are met:

(a) Each fan duct half section may have four loose or missing rivets per inner Z shaped bracket for a total of 16 loose or missing rivets per fan duct half section, thus a total of 32 loose or missing rivets per fan duct assembly.

(b) There is no restriction relative to the circumferential spacing between loose or missing rivets.

(2) Fan ducts that have loose or missing rivets that are more than the limits, must be removed from service and repaired.

Task 72-00-00-210-020:

21. Hot Section Inspection With A Flexible Fiberoptic Borescope (Applicable Only When Specified Overtemperature Has Occurred)

A. Equipment And Materials Required - None

B. Procedure

WARNING: DO BORESCOPE INSPECTION IN AN AREA WHICH HAS PROTECTION FROM THE WEATHER. IF A BORESCOPE INSPECTION IS DONE IN WET CONDITIONS, USE SUFFICIENT PROTECTION TO PREVENT DAMAGE TO EQUIPMENT OR POSSIBLE ELECTRICAL SHOCK TO THE OPERATOR.

CAUTION: ONLY A PERSON WITH THE APPROVED TRAINING CAN DO THIS PROCEDURE AND KNOW THE CORRECT CONDITION OF THE PARTS. YOU MUST EXAMINE ALL THE PARTS WITH THIS BORESCOPE PROCEDURE. DO NOT MAKE A SAMPLE INSPECTION. IF OVERTEMPERATURE OF THE 2ND STAGE TURBINE VANES HAS OCCURRED, MAKE SURE YOU EXAMINE THE CONDITION OF EACH VANE CAREFULLY.

NOTE: It's permitted to use this procedure only as an alternative procedure for specified overtemperature. Refer to the applicable overtemperature limits shown in Section 72-00-00, Adjustment/Test-01.

NOTE: See Task 72-00-00-210-003 for general borescope information.

(1) Make an inspection of the combustion chambers from inside the chambers with a flexible fiberoptic borescope. See Task 72-00-00-210-014 for special equipment and procedure.

NOTE: It is not necessary to examine for circumferential cracks at the lower/seam weld joints, unless this check is used to do all the necessary procedures in ASB 5639.

(a) Examine each combustion chamber for metal that has melted, burning, cracks and bad distortion. See Task 72-00-00-210-014.

(b) Make an inspection of the inner and outer walls of the outlet ducts for damage. See limits in Section 72-51-21, Maintenance Practices-00.

(c) Make an inspection of the 1st stage turbine vanes. See limits in Section 72-50-00, Maintenance Practices-00.

(2) Make and inspection of the 1st stage turbine blades as follows:

(a) Examine the 1st stage turbine blades from the combustion chamber. See limits in Section 72-50-00, Maintenance Practices-00.

1 Put a flexible fiberoptic borescope in the combustion chamber. Refer to Task 72-00-00-210-014.

2 Put the flexible fiberoptic borescope between the 1st stage turbine vanes.

3 Turn the N2 rotor and examine all the 1st stage turbine blades.

(3) Make an inspection of the 4th stage turbine blades with a borescope. See limits in Section 72-50-00, Maintenance Practices-00.

(4) Make an inspection of the 2nd stage turbine vanes through the low turbine with a flexible borescope (for ground starting overtemperature only). Refer to Section 72-50-00, Maintenance Practices-00.

(5) Make an inspection of the 2nd stage turbine blades through the low turbine with a flexible borescope (for ground starting overtemperature only). Refer to Section 72-50-00, Maintenance Practices-00.

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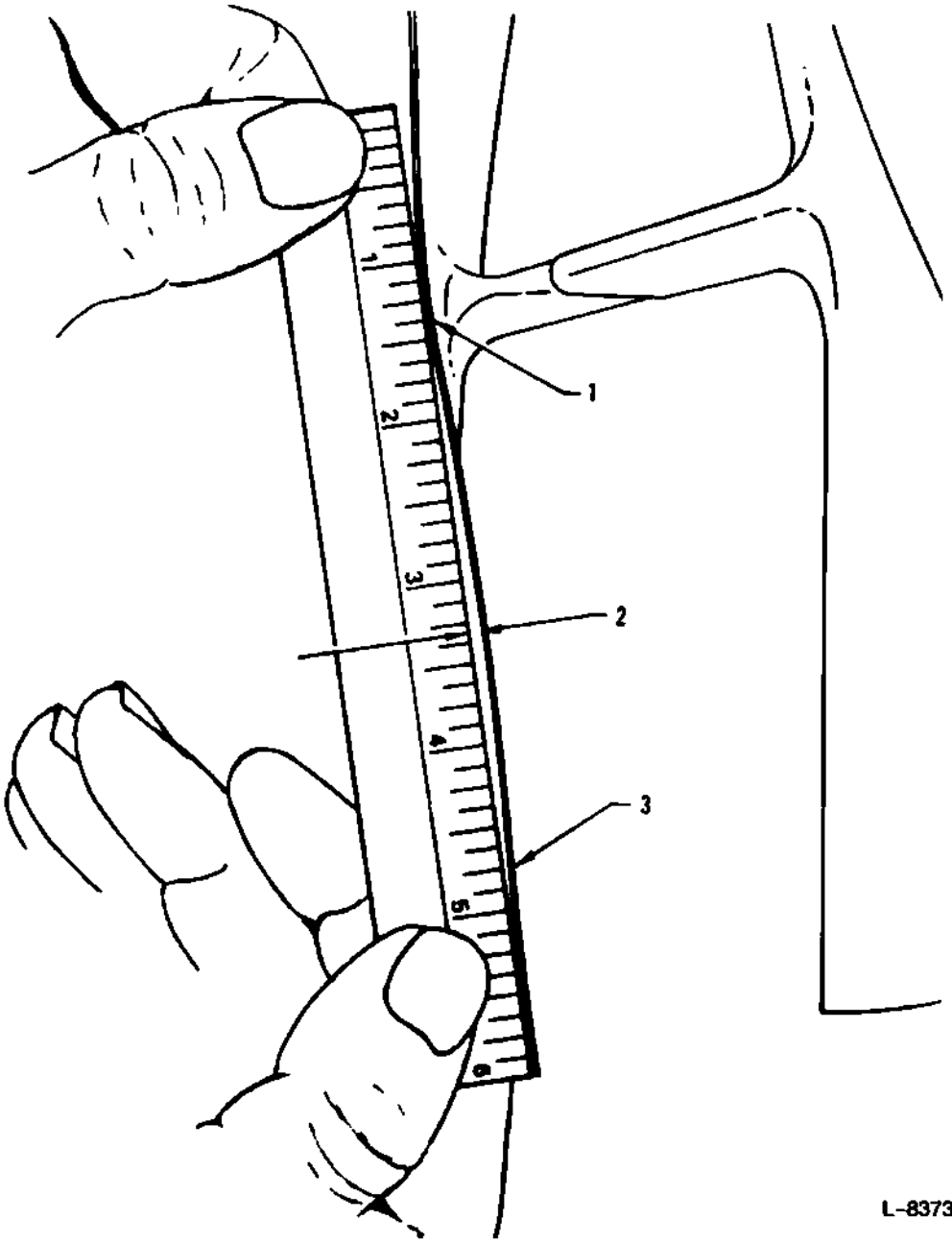
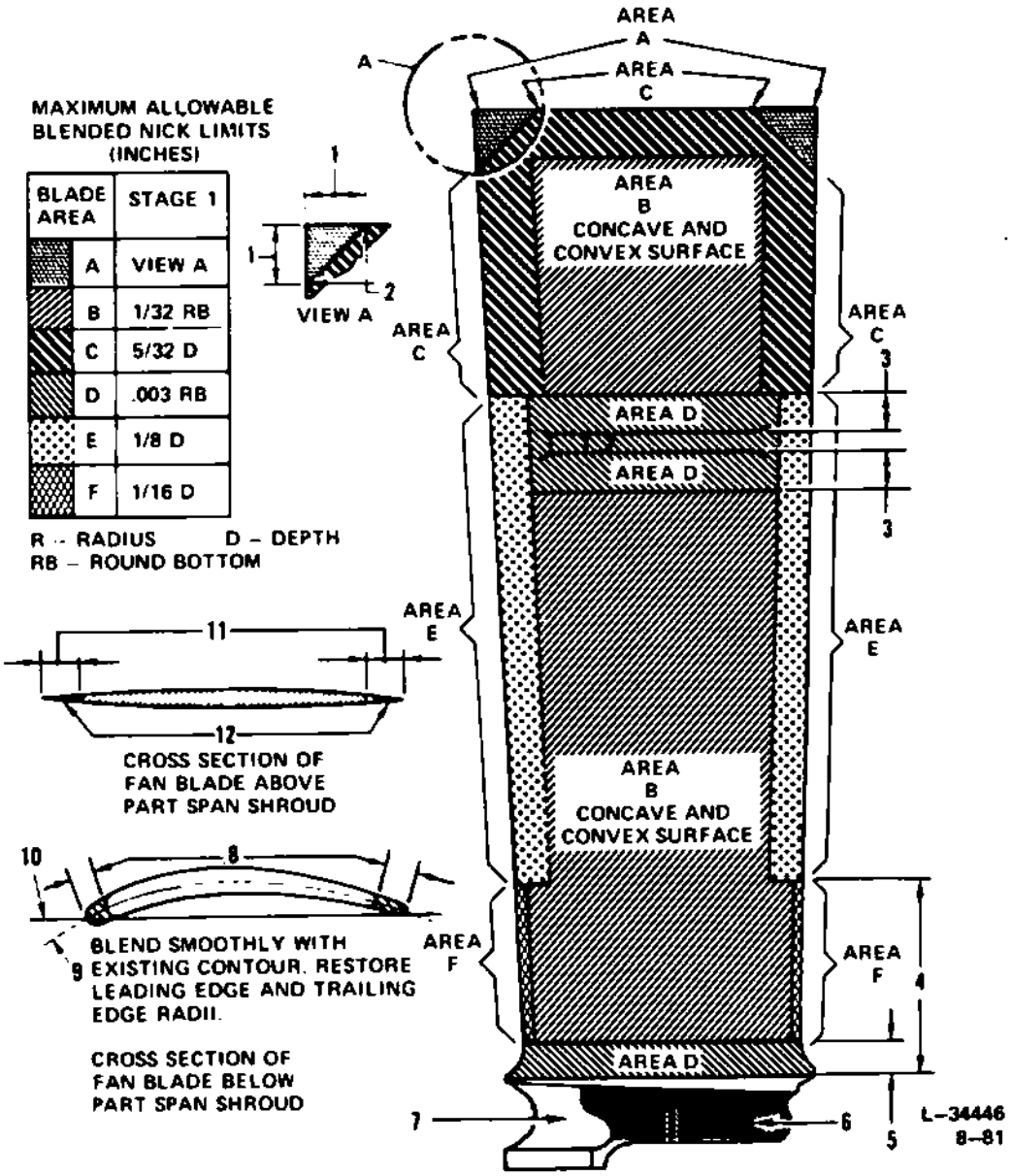


1. Midspan Shroud Convex Contour
2. See Text For This Limit
3. Leading Edge

First Stage Compressor
R Blade Bow Measurement
R Figure 601 (Sheet 1)
(Task 72-00-00-210-020)



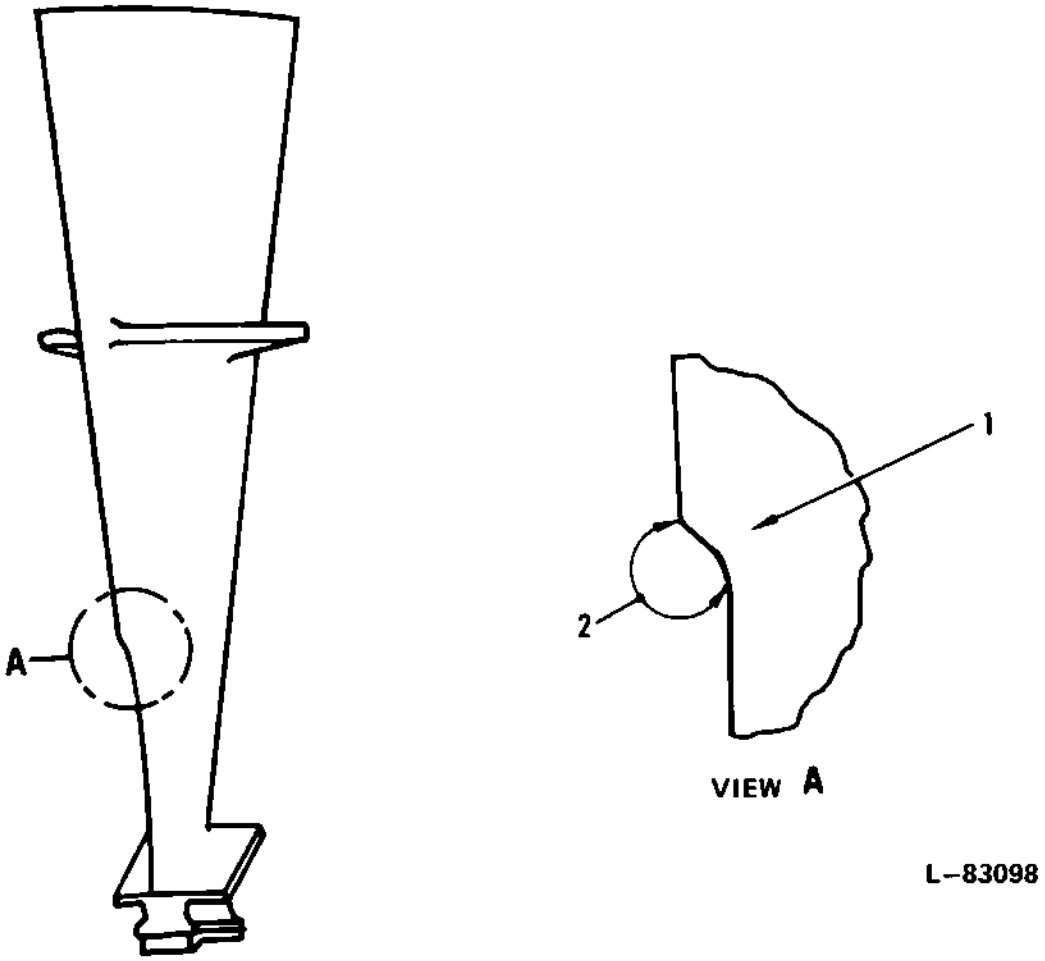
First Stage Compressor Blades
R Service and Repair Limits
R Figure 601 (Sheet 2)
(Task 72-00-00-210-020)

1. 0.750 Inch
2. 0.030 - 0.040 Inch Radius
3. 0.250 Inch
4. 1.500 Inch
5. 0.500 Inch
6. Blade Root Blending Area (Both Sides)
7. Area X; Front And Rear. Blend Damage To 0.020 Inch Maximum Depth. Service Time Marking On Rear Only
8. These Dimensions Controlled By Depth Limit
9. Airfoil Mean Line
10. Chord
11. These Dimensions Controlled By Depth Limit
12. Area C

CAUTION: LIMITS REFERRED TO IN THIS FIGURE IN AREAS C, E, AND F, PERTAIN TO LOCAL, ISOLATED DAMAGED AREAS ONLY, AND MUST NOT BE INTERPRETED AS AUTHORITY FOR REMOVAL OF MATERIAL ALL ACROSS TIP AND LEADING AND TRAILING EDGES AS MIGHT BE DONE IN A SINGLE MACHINING CUT.

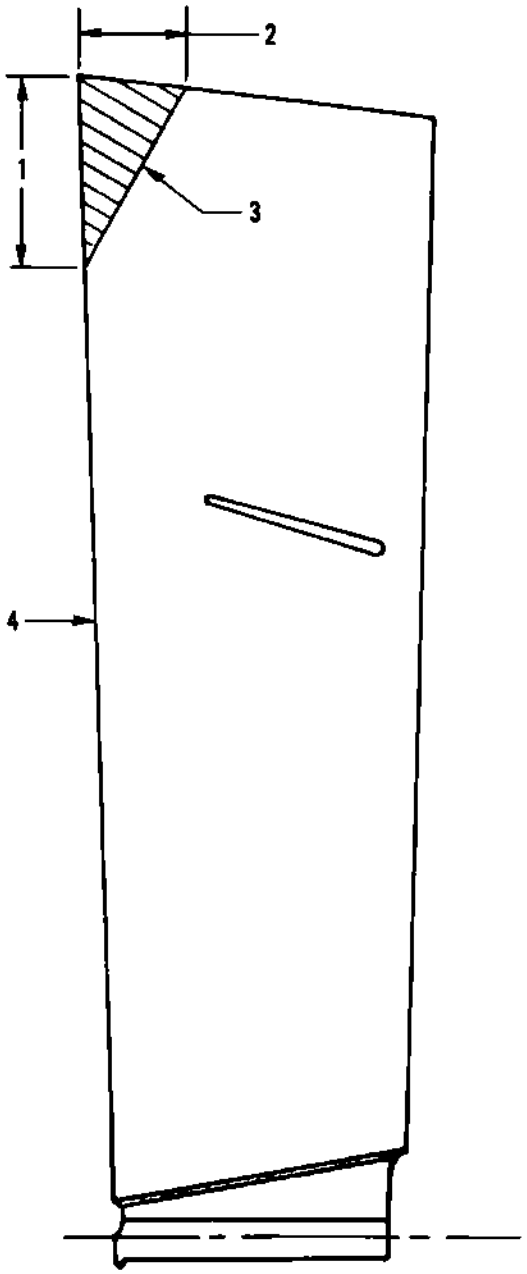
Key to Figure 601 (Sheet 2)

R
R



1. Transition From Maximum To Minimum Chord In Area Where Insert Repair Runs Out.
2. Blend Radius Run-Out. Measure Blend Depth Relative To These Run-Outs.

First Stage Compressor
Blade - Leading Edge
Blend Depth Measurement
Figure 601 (Sheet 3)
(Task 72-00-00-210-020)



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PW C

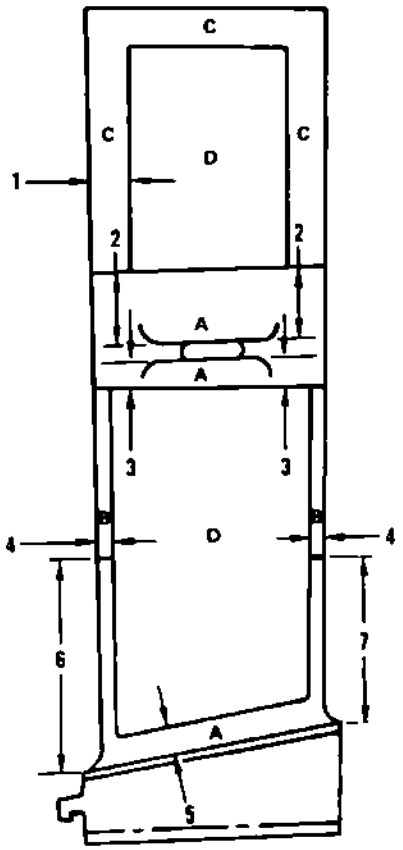
First Stage Compressor Blade
Continue-In-Service Limits
Figure 601 (Sheet 4)
(Task 72-00-00-210-020)

1. 2.150 Inches
2. 0.750 Inch
3. Tip Bend. No Material Removed
4. Leading Edge (Reference)

NOTE: The above limits do not require any repair to continue in service. See text.

Key to Figure 601 (Sheet 4)

AREA	ACCEPTABLE DAMAGE LIMIT, EXCEPT NO TEARS OR CRACKS PERMISSIBLE, INCHES
A	0.003
B	0.005
C	0.020
D	0.010

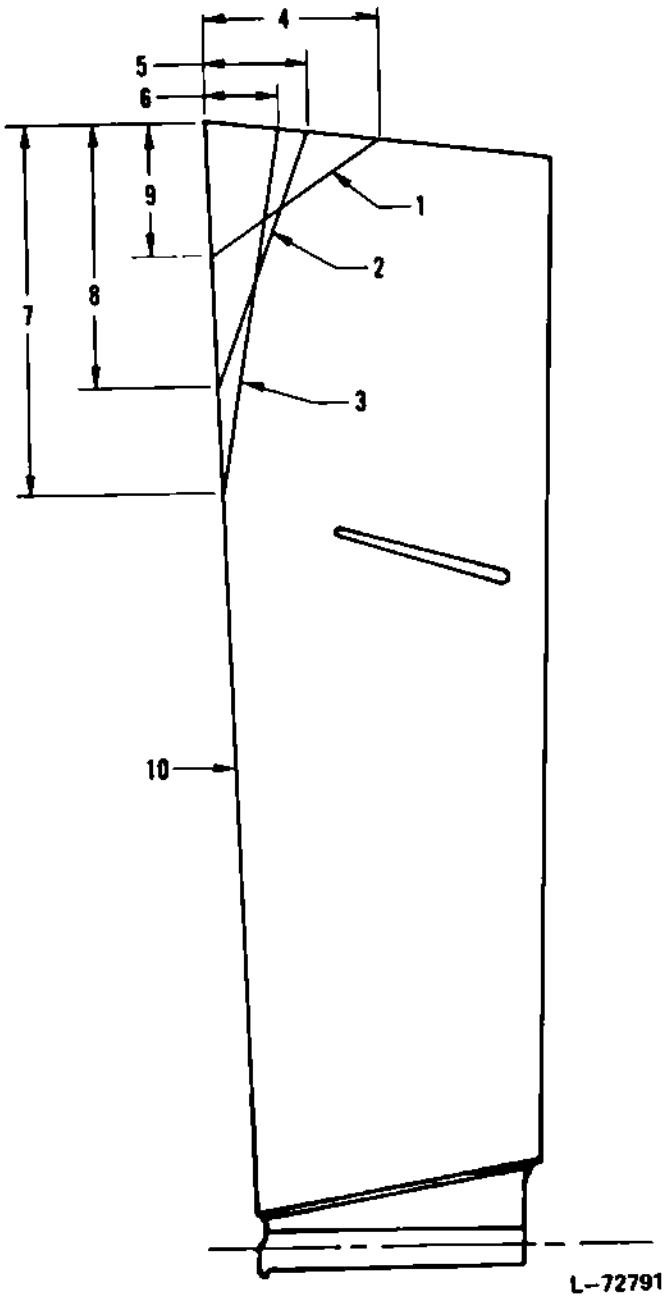


L-83741 (0395)

1. 0.350 Inch
2. 2.000 Inches
3. 0.500 Inch
4. 0.125 Inch
5. 0.500 Inch
6. 3.000 Inches
7. 2.000 Inches

NOTE: The above limits in the table do not require any repair for Areas B, C and D to continue in service. See text.

R First Stage Compressor Blade
R Continue-In-Service Limits
Figure 601 (Sheet 5)
(Task 72-00-00-210-020)

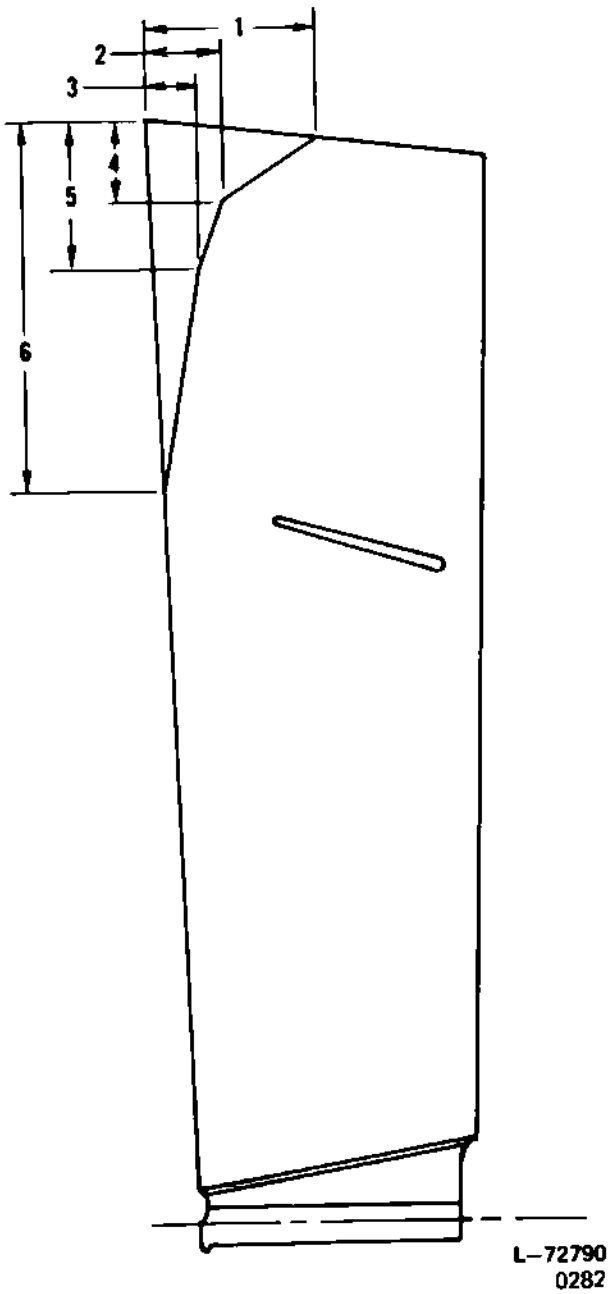


First Stage Compressor Blade
Continue-In-Service Limits
Figure 601 (Sheet 6)
(Task 72-00-00-210-020)

1. Cut No. 1 Or Parallel To This Line
2. Cut No. 2 Or Parallel To This Line
3. Cut No. 3 Or Parallel To This Line
4. 2.000 Inches
5. 1.250 Inches
6. 0.750 Inch
7. 3.850 Inches
8. 2.150 Inches
9. 1.150 Inches
10. Leading Edge (Reference)

NOTE: The above limits require repair for continue-in-service. It is permitted to cut up to the maximum dimensions of only one of the three Indexes 1, 2 or 3. See the text.

Key to Figure 601 (Sheet 6)

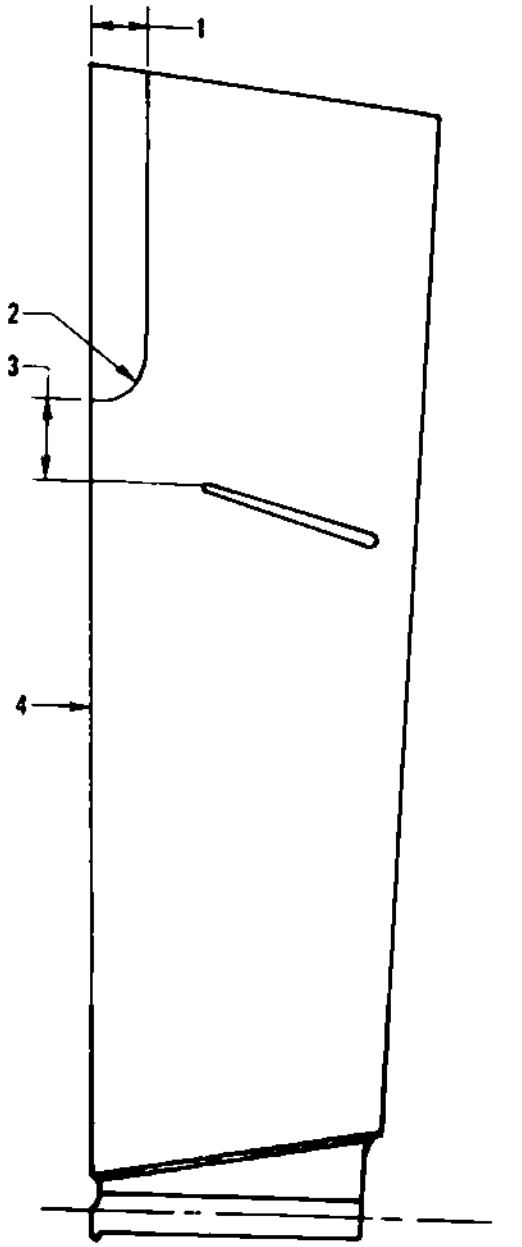


First Stage Compressor Blade
Continue-In-Service Limits
Figure 601 (Sheet 7)
(Task 72-00-00-210-020)

1. 2.000 Inches
2. 0.900 Inch
3. 0.500 Inch
4. 0.600 Inch
5. 1.300 Inch
6. 3.850 Inches

NOTE: The above limits require repair for continue in service.

Key to Figure 601 (Sheet 7)

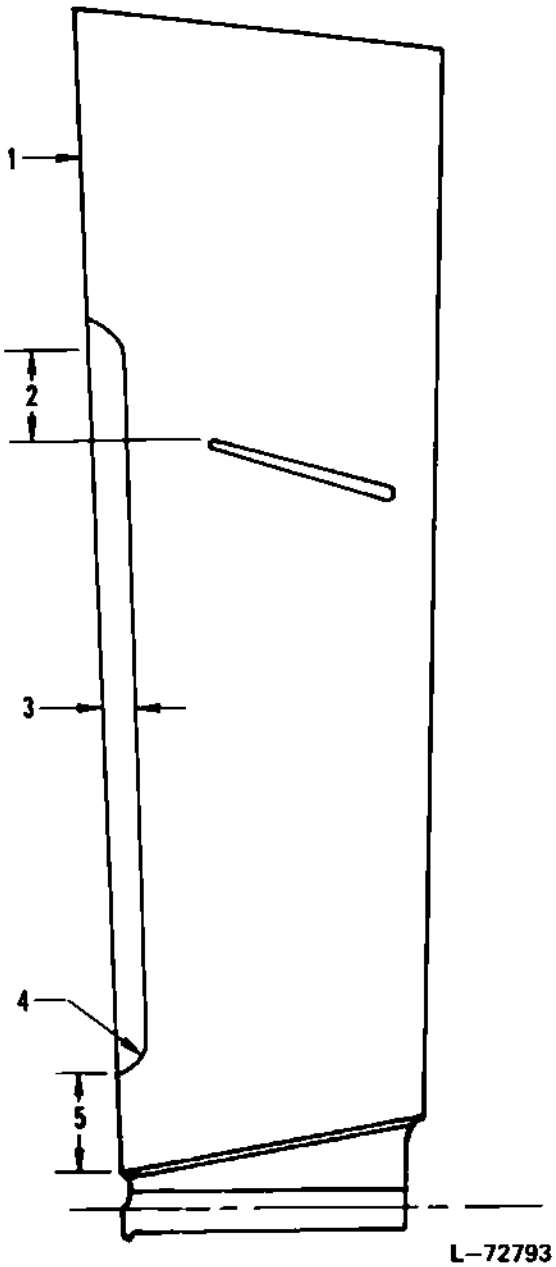


First Stage Compressor Blade
R Continue-In-Service Limits
R Figure 601 (Sheet 8)
(Task 72-00-00-210-020)

1. 0.625 Inch
2. 0.625 Inch Radius
3. 1.000 Inch
4. Leading Edge (Reference)

NOTE: The above limits require repair for continue in service.

Key to Figure 601 (Sheet 8)

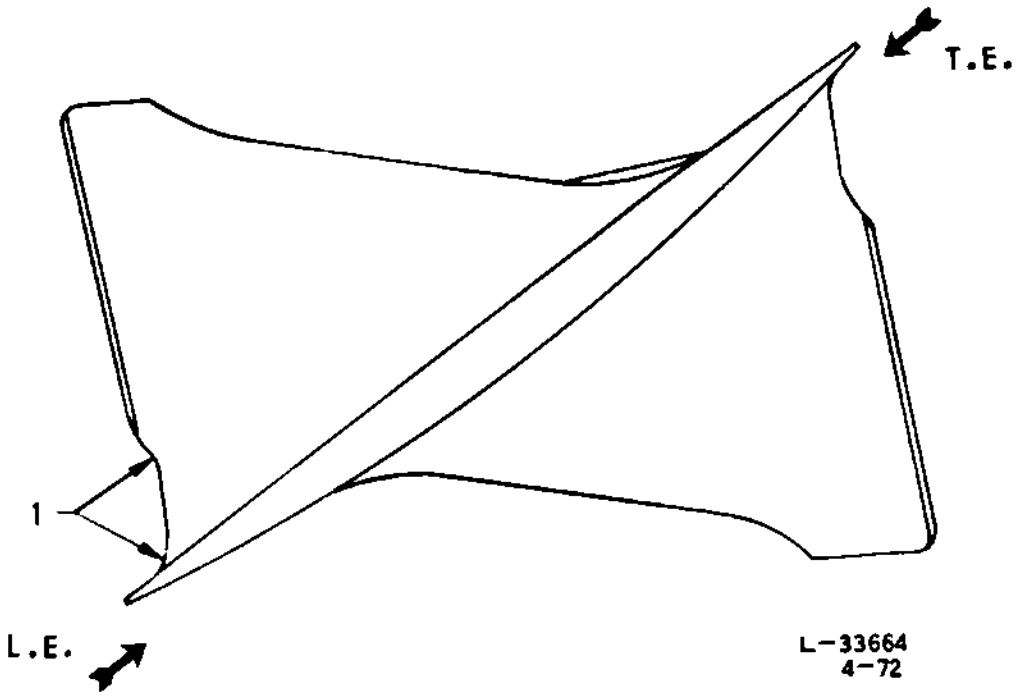


First Stage Compressor
R Blade Flyback Limits
R Figure 601 (Sheet 9)
(Task 72-00-00-210-020)

1. Leading Edge (Reference)
2. 1.000 Inch
3. 0.250 Inch
4. 0.250 Inch Radius. Two (2) Places.
5. 1.500 Inch

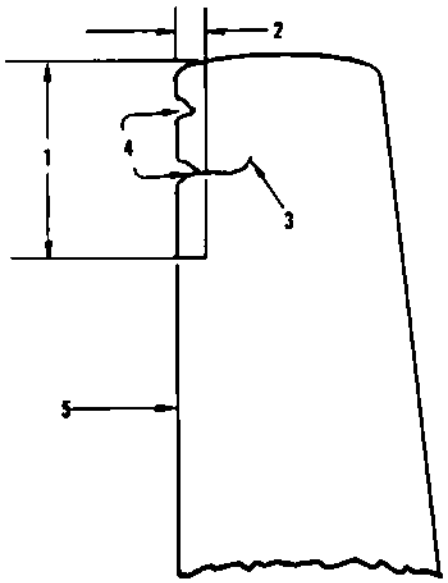
NOTE: The above repair limits permit the blade to continue-in-service for a maximum of 20 hours only. These limits are to be used for aircraft flyback purposes only.

Key to Figure 601 (Sheet 9)



1. 0.234 to 0.266 Inch Radius

First Stage Compressor Blade
R Mid-Span Shroud Repair Limits
R Figure 601 (Sheet 10)
(Task 72-00-00-210-020)



L-81203 (0000)

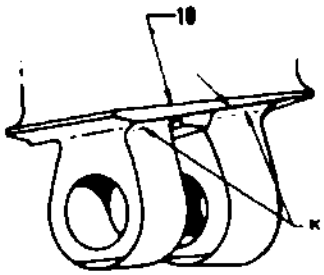
1. 1.000 Inch
2. 0.250 Inch
3. Crack Progression Beyond 0.250 Inch Is Not Acceptable.
4. Small Tears Less Than 0.250 Inch Deep Are Acceptable. See Text.
5. Leading Edge

Second Stage Compressor
R Blade Non-Repaired Damage
R Figure 602 (Sheet 1)
(Task 72-00-00-210-020)

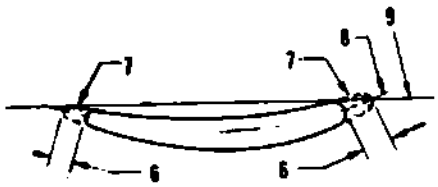
MAXIMUM ALLOWABLE
BLENDED NICK LIMITS

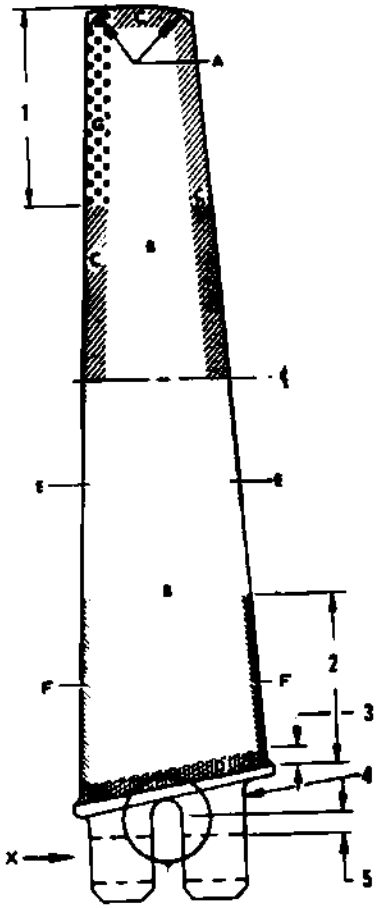
BLADE AREA		STAGE 2
	A	5/16 R
	B	1/32 RB
	C	5/32 D
	D	NONE
	E	1/8 D
	F	1/16 D
	G	3/16 D

R-RADIUS
D-DEPTH
RB-ROUND BOTTOM



VIEW X





CAUTION

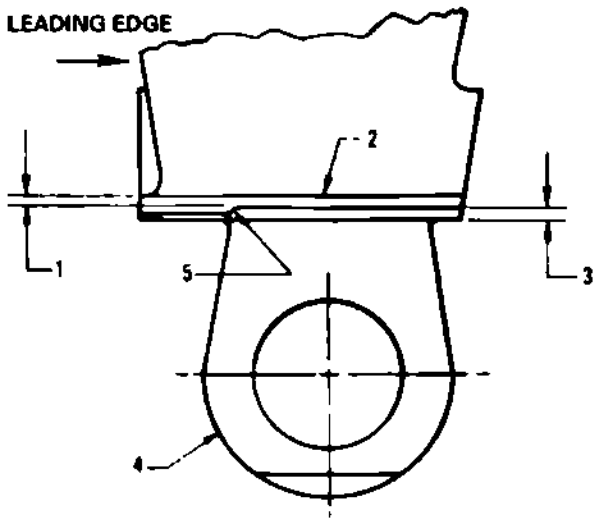
LIMITS IN AREAS "C," "E," AND "F" PERTAIN TO LOCAL, ISOLATED DAMAGE AREAS ONLY AND MUST NOT BE INTERPRETED AS AUTHORITY FOR MATERIAL REMOVAL ACROSS ENTIRE TIP OF LEADING AND TRAILING EDGES, AS MIGHT BE DONE IN SINGLE MACHINING CUT.

BLEND SMOOTHLY WITH EXISTING CONTOUR. RESTORE LEADING AND TRAILING EDGE RADII.

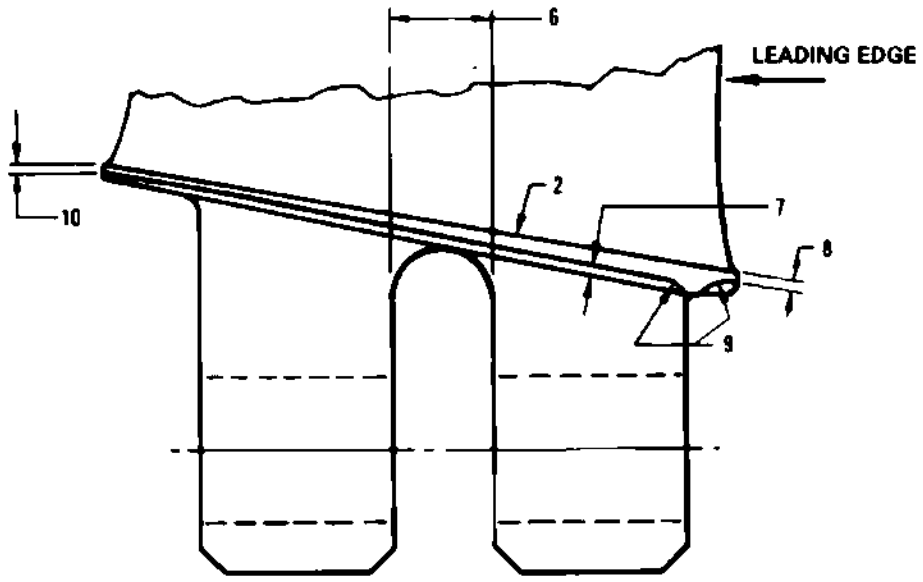
L-31767
0688

1. 2.0 Inches
2. 1.5 Inches
3. 0.250 Inch
4. Service Time Marking Area
5. 0.100 Inch Minimum
6. These Dimensions Controlled By Depth Limit.
7. Areas C, E and F
8. Airfoil Mean Line
9. Chord
10. Break Sharp Edges 0.003 to 0.005 Inch.
    Radius Upper and Lower Edges All Sides.

Key to Figure 602 (Sheet 2)



FRONT VIEW



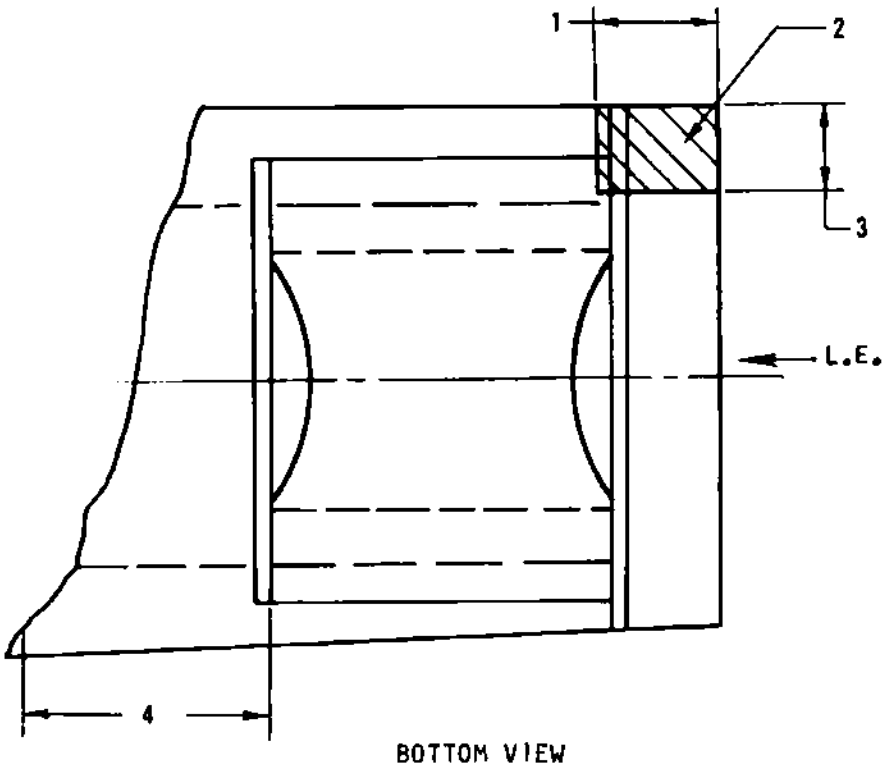
SIDE VIEW

L-30476 (0971
PW C

1. 0.030 Inch Minimum
2. Top of Blade Platform (Reference)
3. 0.050 Inch Maximum
4. Blade Root (Reference)
5. 0.050 Inch Radius Minimum
6. No Unrepaired Surface Damage Allowed. Blend Local Damage to Depth of 0.010 Inch Maximum. Blend Repair Not Permissible Within 0.200 Inch of Pinholes.
7. 0.050 Inch Maximum
8. 0.030 Inch Minimum
9. 0.050 Inch Radius Minimum
10. 0.030 Inch Minimum

Key to Figure 602 (Sheet 3)

R
R

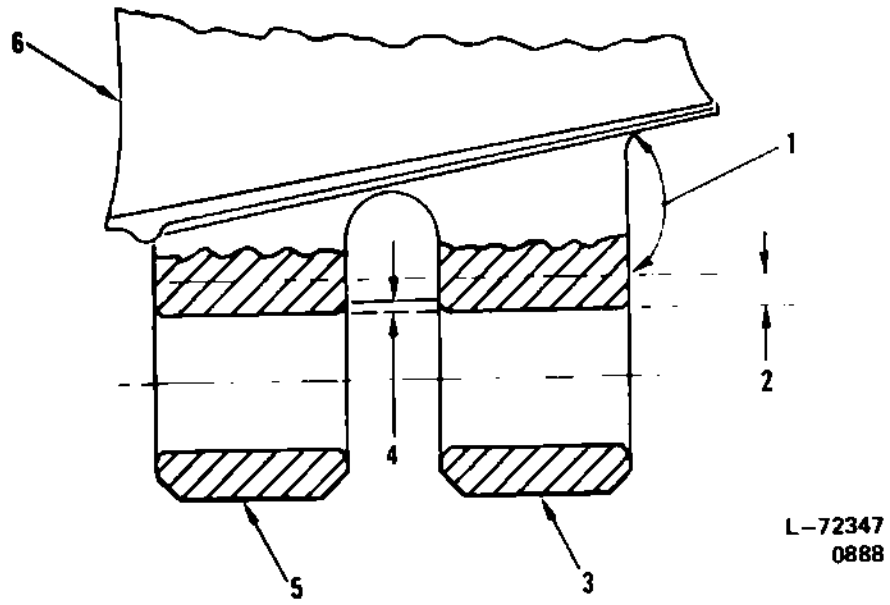


BOTTOM VIEW

L-33763 (0000)
PW C

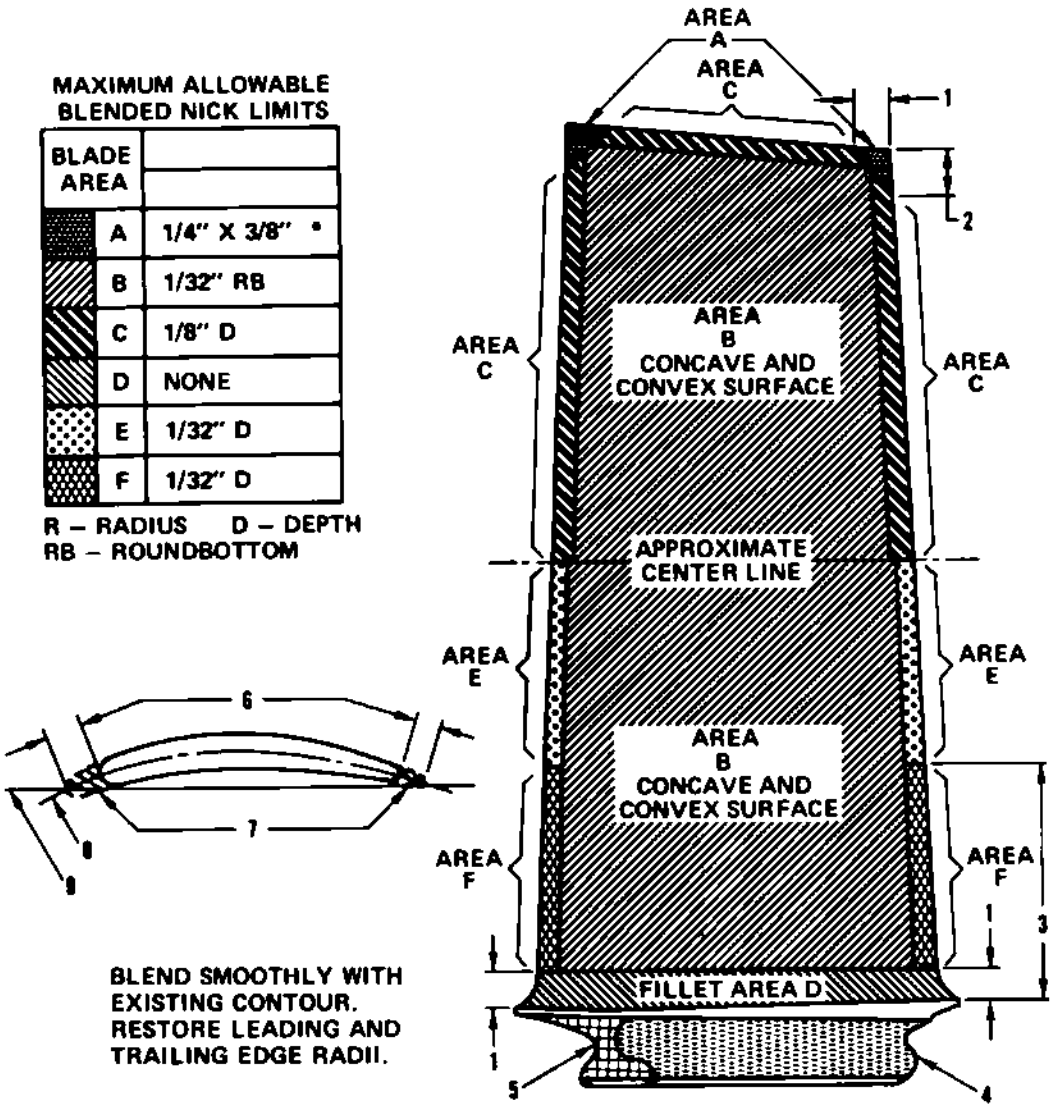
1. 0.300 Inch
2. Area A Blend All Local Damage Up To 0.030 Inch Deep Maintaining 0.030 Inch Minimum Leading Edge Wall Thickness. Blends Should Have Minimum of 0.050 Inch Radius. Avoid Excessive Material Removal.
3. 0.300 Inch
4. 0.010 Blend Limits. See Ref. No. 6 In Sheet 2 of Figure. No Further Repair Permitted In This Area.

R Second Stage Platform
R (Bottom View)
Figure 602 (Sheet 4)
(Task 72-00-00-210-020)



1. Permissible To Blend Both Lugs All Around To Depth Of 0.010 Inch Maximum.
2. Blending Not Permitted Within 0.100 Inch Of Pin Holes, All Around, Four Places.
3. Rear Lug
4. Unblended Damage Allowed Within 0.050 Inch Of Hole 0.002 Inch Deep, All Around, On Front Face Of Rear Lug For Blades With Single Thrust Washers And On Rear Face Of Front Lug And On Front Face Of Rear Lug For Blades With Two Thrust Washers.
5. Front Lug
6. Leading Edge

R Second Stage Blade Root Blending
R Figure 602 (Sheet 5)
(Task 72-00-00-210-020)

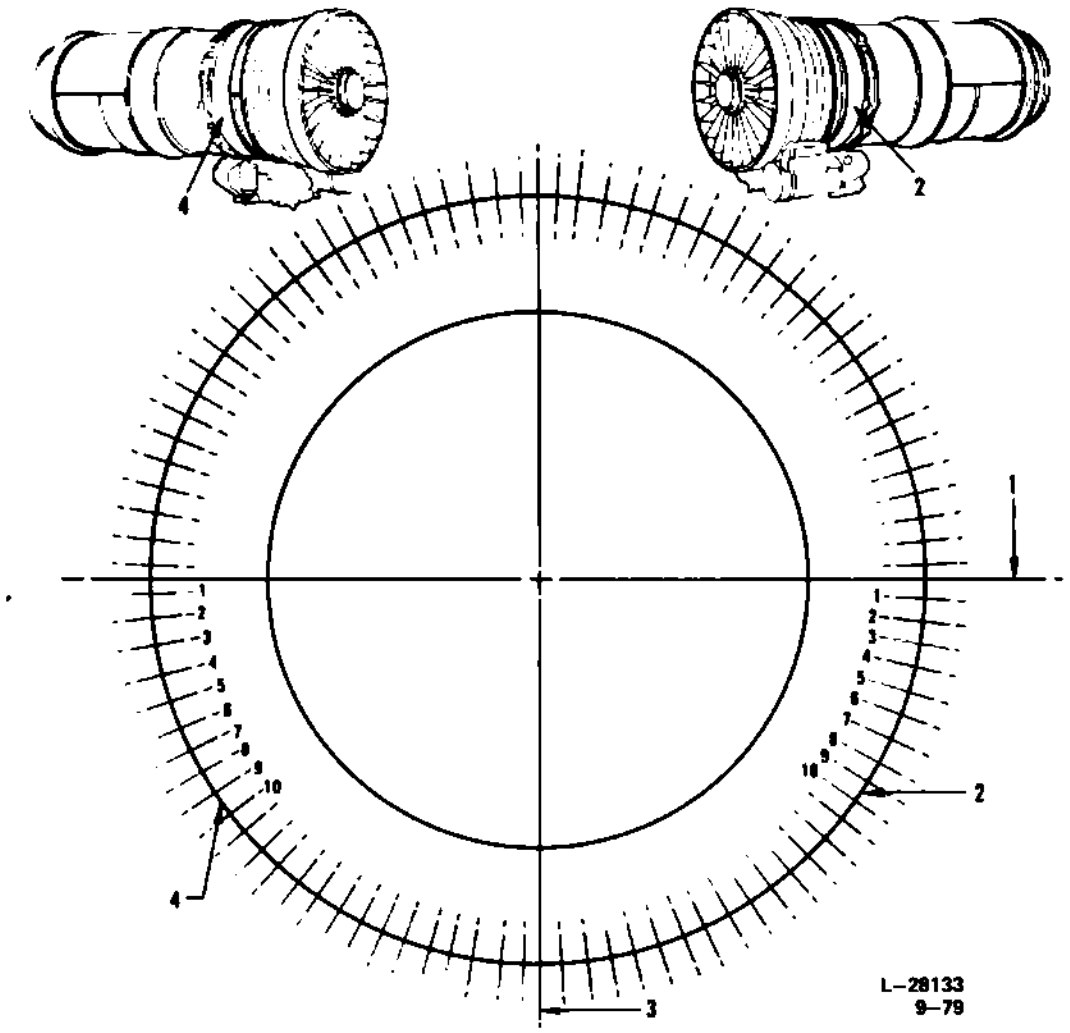


* 3/16" X 3/16" MAX. IF BOTH LEADING AND TRAILING EDGE TIP BLENDED. BLEND A RADIUS BASED ON ACTUAL DAMAGE AND IF NECESSARY UP TO THE MAXIMUM LENGTH STIPULATED.

1. 0.250 Inch
2. 0.375 Inch
3. 1.500 Inch
4. Area Y; Both Sides
5. Area X; Front and Rear. Service Time Marking on Rear Face Only.
6. These Dimensions Controlled by Depth Limit.
7. Areas C, E, and F.
8. Airfoil Mean Line
9. Chord

CAUTION: LIMITS IN AREA C, E, AND F, PERTAIN TO LOCAL, ISOLATED DAMAGED AREAS ONLY, AND MUST NOT BE INTERPRETED AS AUTHORITY FOR MATERIAL REMOVAL ACROSS ENTIRE TIP OF LEADING OR TRAILING EDGES, AS MIGHT BE DONE IN A SINGLE MACHINING CUT.

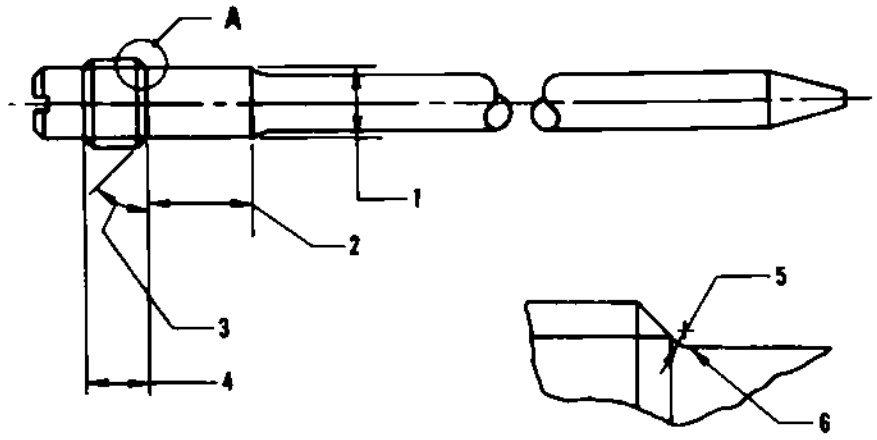
Key to Figure 603



SCHEMATIC FRONT VIEW OF FLANGE "F"

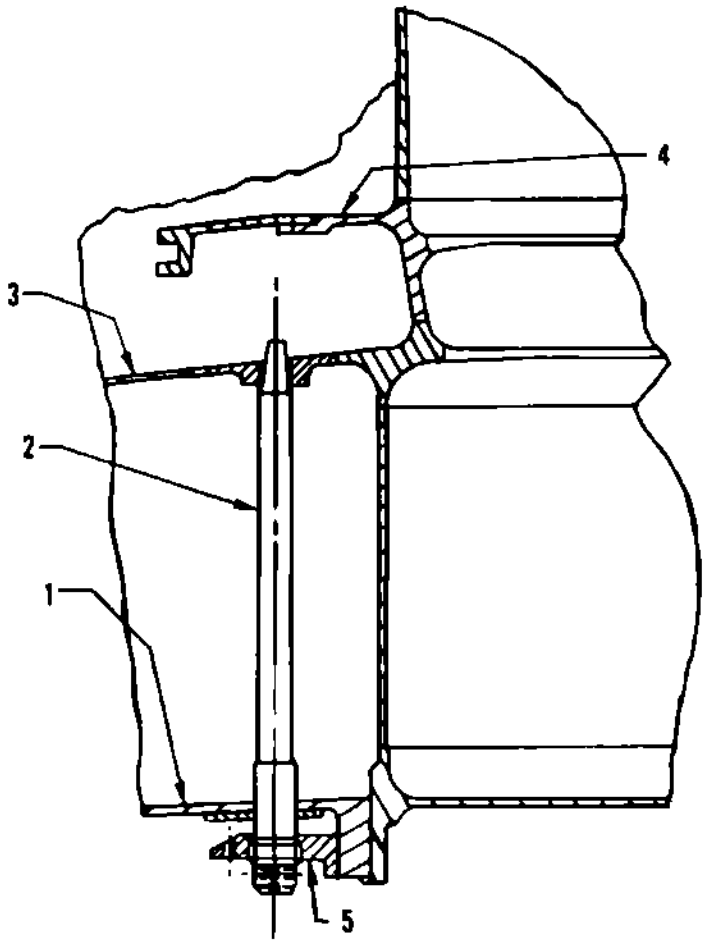
1. Horizontal Centerline of Engine
2. Port Location (Left Side)
3. Vertical Centerline of Engine
4. Port Location (Right Side)

R Sixth Stage Borescope Hole Locations
R Figure 604
(Task 72-00-00-210-020)



L-27145 (0000)
PW C

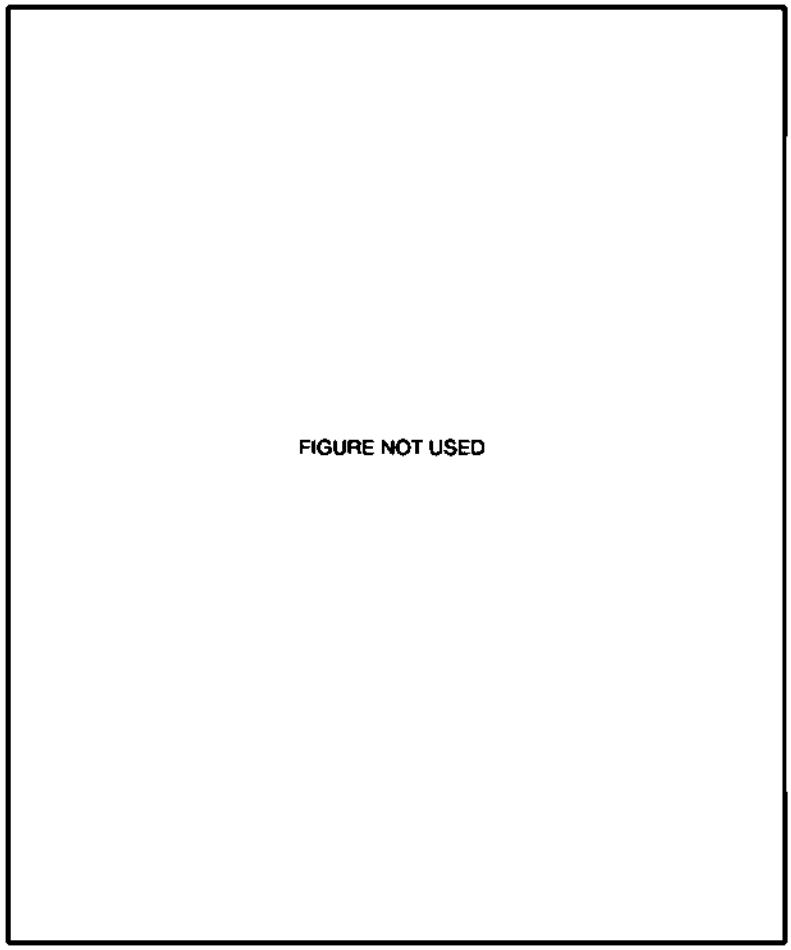
1. 0.415 to 0.417 Inch Diameter
2. Index 1 For This Distance
3. 45 Degrees (Approximately)
4. 0.270 to 0.290
5. 0.006 to 0.026 Inch Radius
6. Cadmium Plate Requirement on Machined Area Waived.



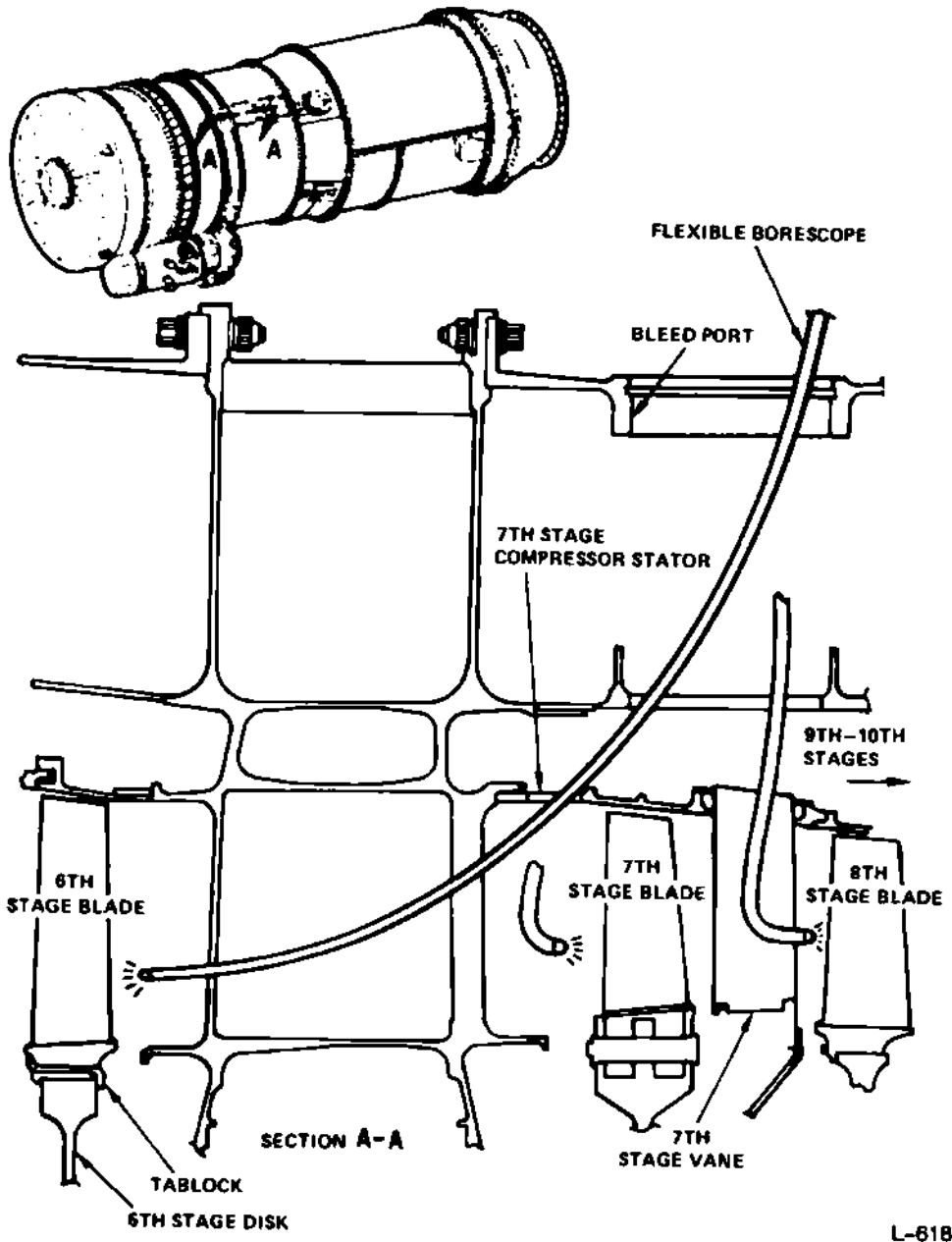
L-24850 (0270)
PW C

1. Fan Duct
2. Borescope Plug
3. Intermediate Case
4. Sixth Stage Stator Shroud
5. Bracket

R Sixth Stage Borescope
R Hole Plug Installation
Figure 606
(Task 72-00-00-210-020)



R Figure Not Used
R Figure 607
(Task 72-00-00-210-020)

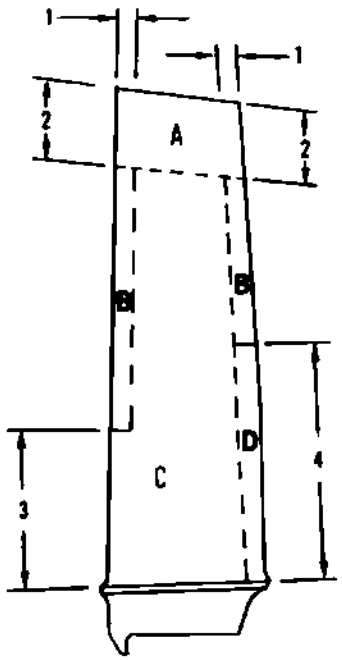


6th Through 10th Stage Borescope
R Inspection Through Bleed Port
R Figure 608
(Task 72-00-00-210-020)

BLADE AREA	PERMITTED DAMAGE LIMITS
A	ANY DAMAGE
B	ANY DENT* TEARS UP TO 1/8 INCH
C	ANY DENT* NO TEARS OR CRACKS
D	NO DAMAGE IS PERMITTED BUT ANOMALIES ARE PERMITTED UP TO 0.005 IN (0.127 mm) DEEP IN AREA 0.25 IN (6.350 mm) ABOVE THE PLATFORM **

*DENTS MUST BE SMOOTH AND ROUNDED WITHOUT CRACKS,TEARS OR MATERIAL REMOVED.

**THE SURFACE ANOMALIES SHOULD BE SMOOTH, ROUND BOTTOM, AND MUST NOT HAVE CRACKS, RAISED MATERIAL OR TEARS.

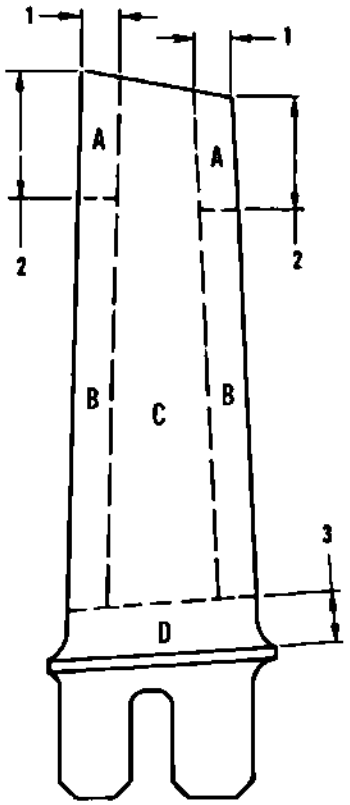


L-89648 (0201)

1. 1/8 Inch (3.175 mm)
2. 1/2 Inch (12.700 mm)
3. One Inch (25.400 mm)
4. One And 1/2 Inch (38.100 mm)

R Sixth Stage Blade
R Inspection Limits
Figure 609
(Task 72-00-00-210-020)

BLADE AREA	PERMITTED DAMAGE LIMITS
A	ANY TYPE OF DAMAGE UP TO 1/8 in (3.175 mm) MAXIMUM
B	ANY TYPE OF DAMAGE UP TO 0.020 in (0.508 mm) AND DENTS * UP TO 0.047 in (1.194 mm)
C	ANY DENT * NO TEARS OR CRACKS
D	† DENTS * UP TO 0.005 IN. (0.127 mm)



* DENTS MUST BE SMOOTH AND ROUNDED WITHOUT CRACKS, TEARS OR MATERIAL REMOVED.

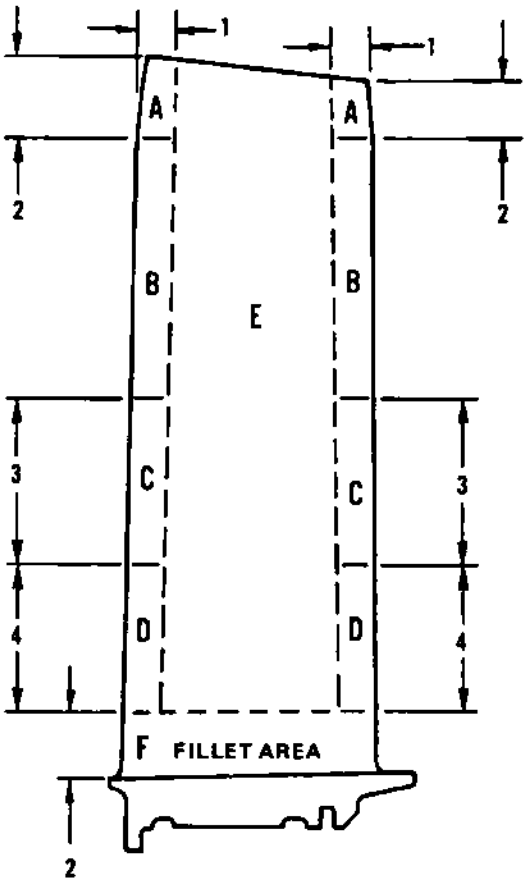
† DAMAGE THAT IS MORE THAN 0.002 IN. (0.051 mm) BUT LESS THAN 0.005 IN. (0.127 mm) MUST HAVE A BORESCOPE INSPECTION EVERY 950 HOURS OR LESS.

L-79398 (0199)

1. 1/8 Inch
2. 3/4 Inch
3. 1/4 Inch

Seventh Stage Blade
Inspection Limits
Figure 610
(Task 72-00-00-210-020)

AREA	PERMITTED DAMAGE LIMITS
A	TEARS, NICKS AND INDENTATIONS UP TO 1/8 INCH (3.175mm)
B	SHARP INDENTATIONS UP TO 1/16 INCH (1.588mm) SMOOTH INDENTATIONS UP TO 1/8 INCH (3.175mm) NO TEARS OR CRACKS
C	SHARP INDENTATIONS UP TO 0.020 INCH (0.508mm) SMOOTH INDENTATIONS UP TO 1/32 INCH (0.793mm) NO TEARS OR CRACKS
D	SHARP INDENTATIONS UP TO 0.010 INCH (0.254mm) SMOOTH INDENTATIONS UP TO 1/32 INCH (0.792mm) NO TEARS OR CRACKS
E	ANY INDENTATION EXCEPT NO TEARS OR CRACKS
F	NONE



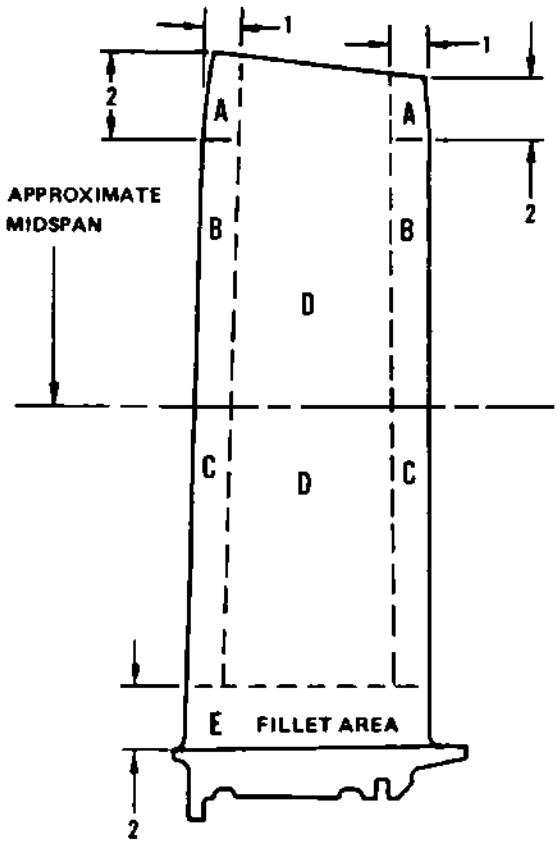
8TH STAGE BLADE

L-H0913

1. 1/8 Inch (3.175 mm)
2. 1/4 Inch (6.350 mm)
3. 0.600 Inch (15.240 mm)
4. 0.500 Inch (12.700 mm)

R 8th Stage Blade Inspection Limits
R Figure 611
(Task 72-00-00-210-020)

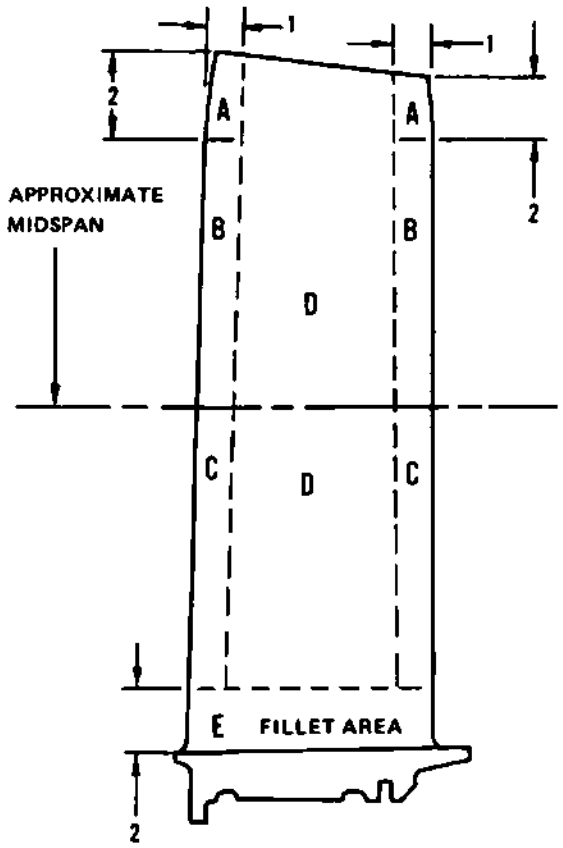
AREA	PERMITTED DAMAGE LIMITS
A	TEARS, NICKS AND INDENTATIONS UP TO 1/8 INCH (3.175mm)
B	SHARP INDENTATIONS UP TO 1/16 INCH (1.588mm) SMOOTH INDENTATIONS UP TO 1/8 INCH (3.175mm) NO TEARS OR CRACKS
C	SHARP INDENTATIONS UP TO 0.020 INCH (0.508mm) SMOOTH INDENTATIONS UP TO 1/32 INCH (0.793mm) NO TEARS OR CRACKS
D	ANY INDENTATION EXCEPT NO TEARS OR CRACKS
E	NONE



1. 1/8 Inch (3.175 mm)
2. 1/4 Inch (6.350 mm)

R 9th Stage Blade Inspection Limits
R Figure 612
(Task 72-00-00-210-020)

AREA	PERMITTED DAMAGE LIMITS
A	TEARS, NICKS AND INDENTATIONS UP TO 1/8 INCH (3.175mm)
B	SHARP INDENTATIONS UP TO 1/16 INCH (1.588mm) SMOOTH INDENTATIONS UP TO 1/8 INCH (3.175mm) NO TEARS OR CRACKS
C	SHARP INDENTATIONS UP TO 0.020 INCH (0.508mm) SMOOTH INDENTATIONS UP TO 1/32 INCH (0.793mm) NO TEARS OR CRACKS
D	ANY INDENTATION EXCEPT NO TEARS OR CRACKS
E	NONE

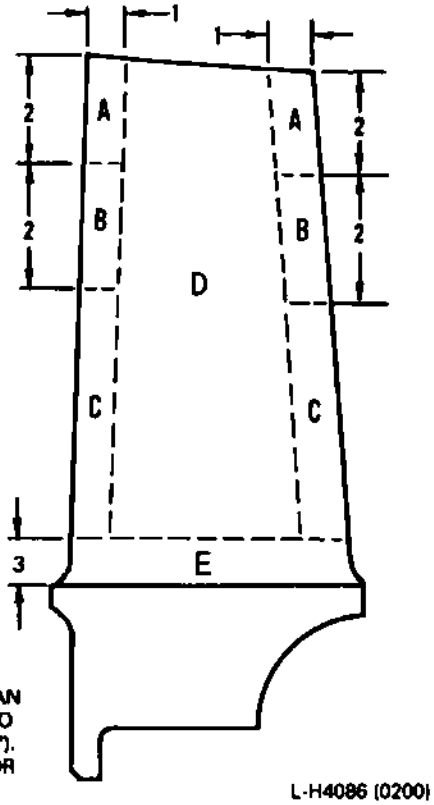


1. 1/8 Inch (3.175 mm)
2. 1/4 Inch (6.350 mm)

R 10th Stage Blade Inspection Limits
R Figure 613
(Task 72-00-00-210-020)

AREA	ACCEPTABLE DAMAGE LIMITS
A	ANY DAMAGE UP TO 1/16 INCH (1.588mm) ANY ROUND BOTTOMED DAMAGE UP TO .135 INCH (3.429mm) NO TEARS OR CRACKS ALLOWED BEYOND 1/16 INCH (1.588mm)
B	ANY DAMAGE UP TO 1/16 INCH (1.588mm) ANY ROUND BOTTOMED DAMAGE UP TO .135 INCH (3.429mm) NO TEARS OR CRACKS ALLOWED BEYOND 1/16 INCH (1.588mm)
C	INDENTATIONS UP TO 1/32 INCH (0.793mm) NO TEARS OR CRACKS
D	ANY INDENTATION NO TEARS OR CRACKS
E	INDENTATIONS UP TO 0.010 INCH (0.254mm) NO TEARS OR CRACKS

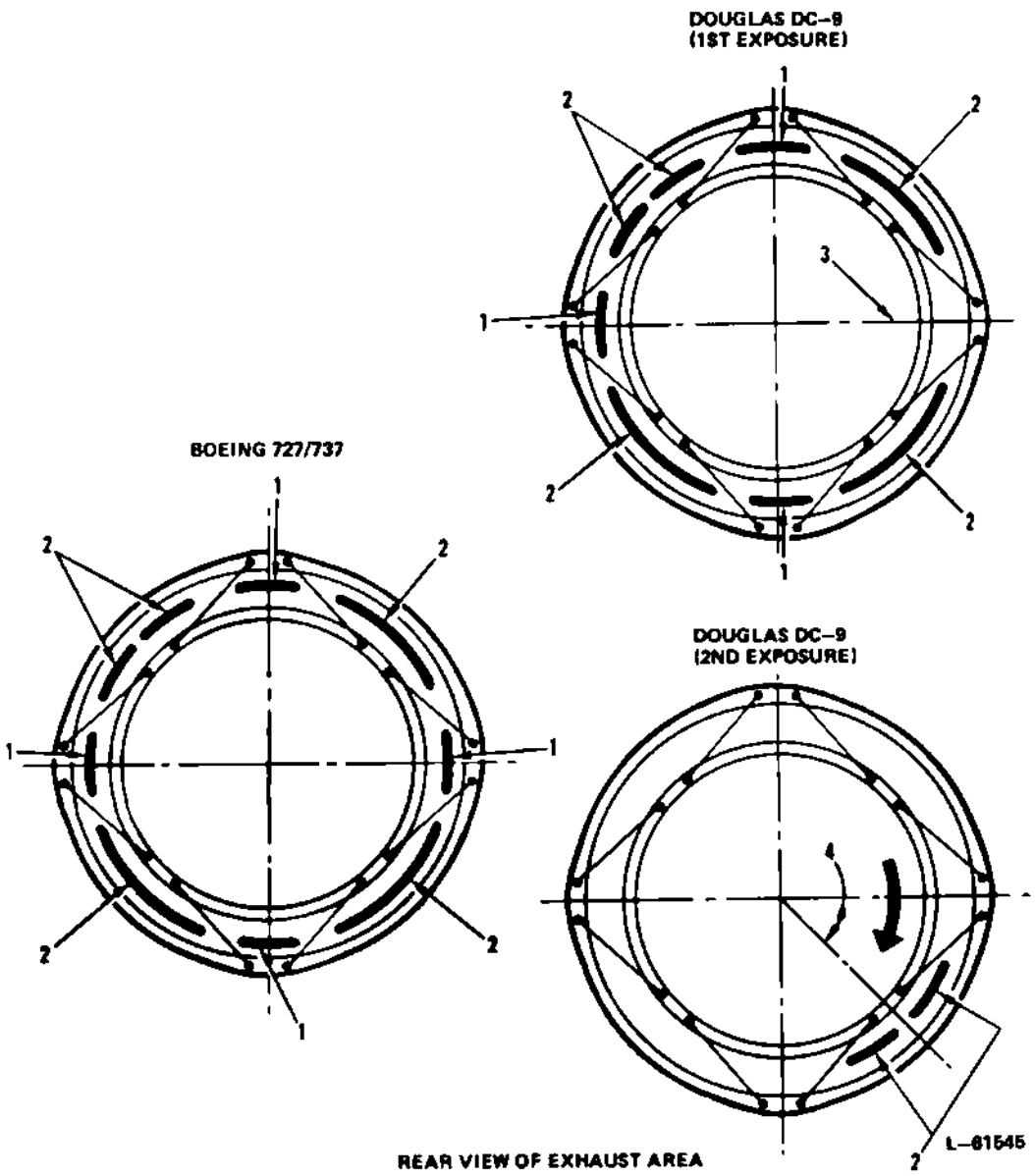
NOTE: DAMAGE THAT TRANSCENDS DEFINED BOUNDARIES CAN BE ADDRESSED BY ALLOWING THE GREATER DAMAGE LIMIT TO PREVAIL (NO TEARS OR CRACKS ALLOWED IN AREAS "C" OR "D"). THIS NOTE DOES NOT APPLY BETWEEN BOUNDARY "C TO "E" OR "D TO "E".



L-H4086 (0200)

1. 3/16 Inch
2. 1/4 Inch
3. 1/8 Inch

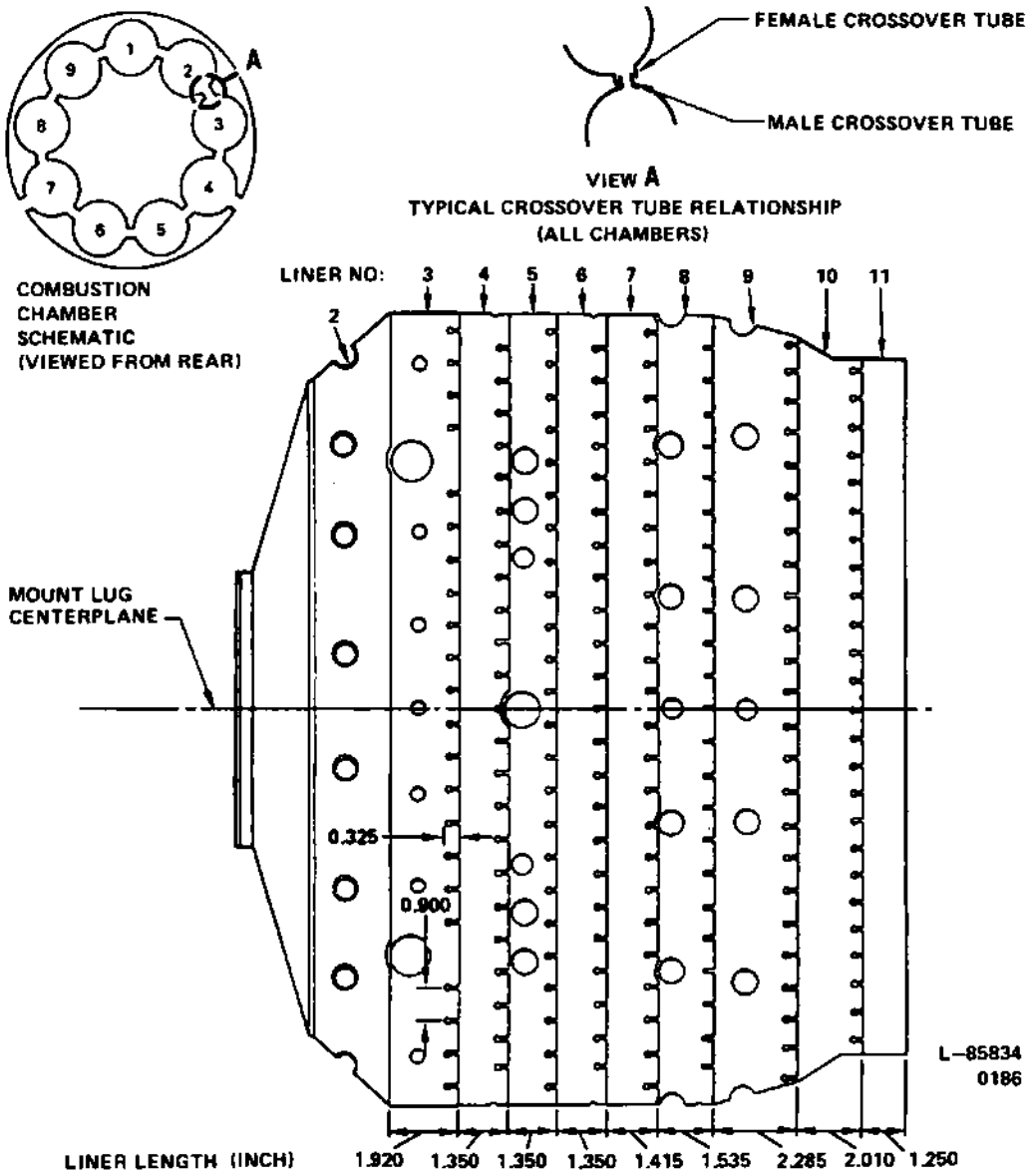
R Twelfth And Thirteenth
R Stage Blade Damage Limits
Figure 614
(Task 72-00-00-210-020)

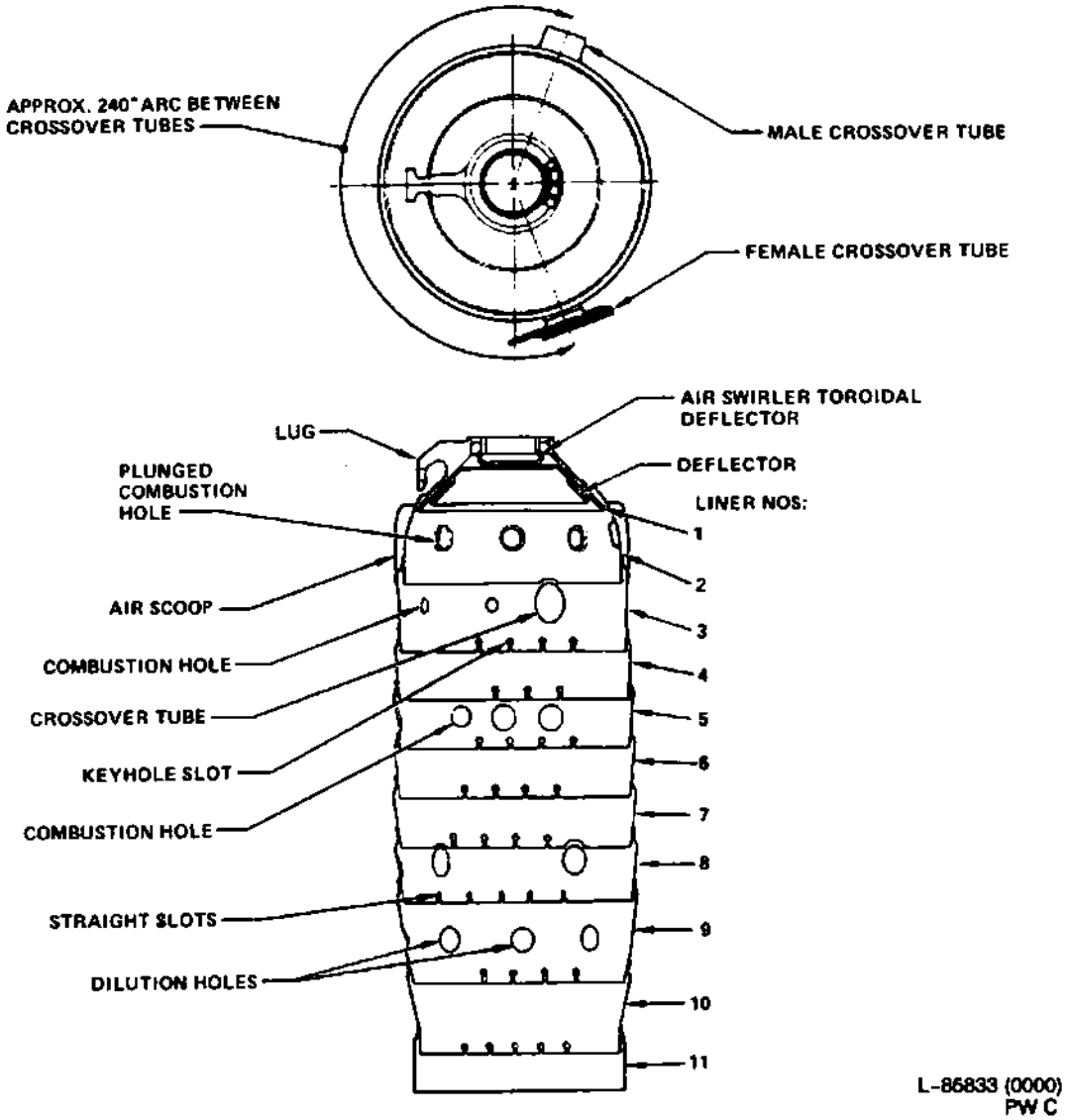


Engine Isotope Inspection
R Film Placement
R Figure 615
(Task 72-00-00-210-020)

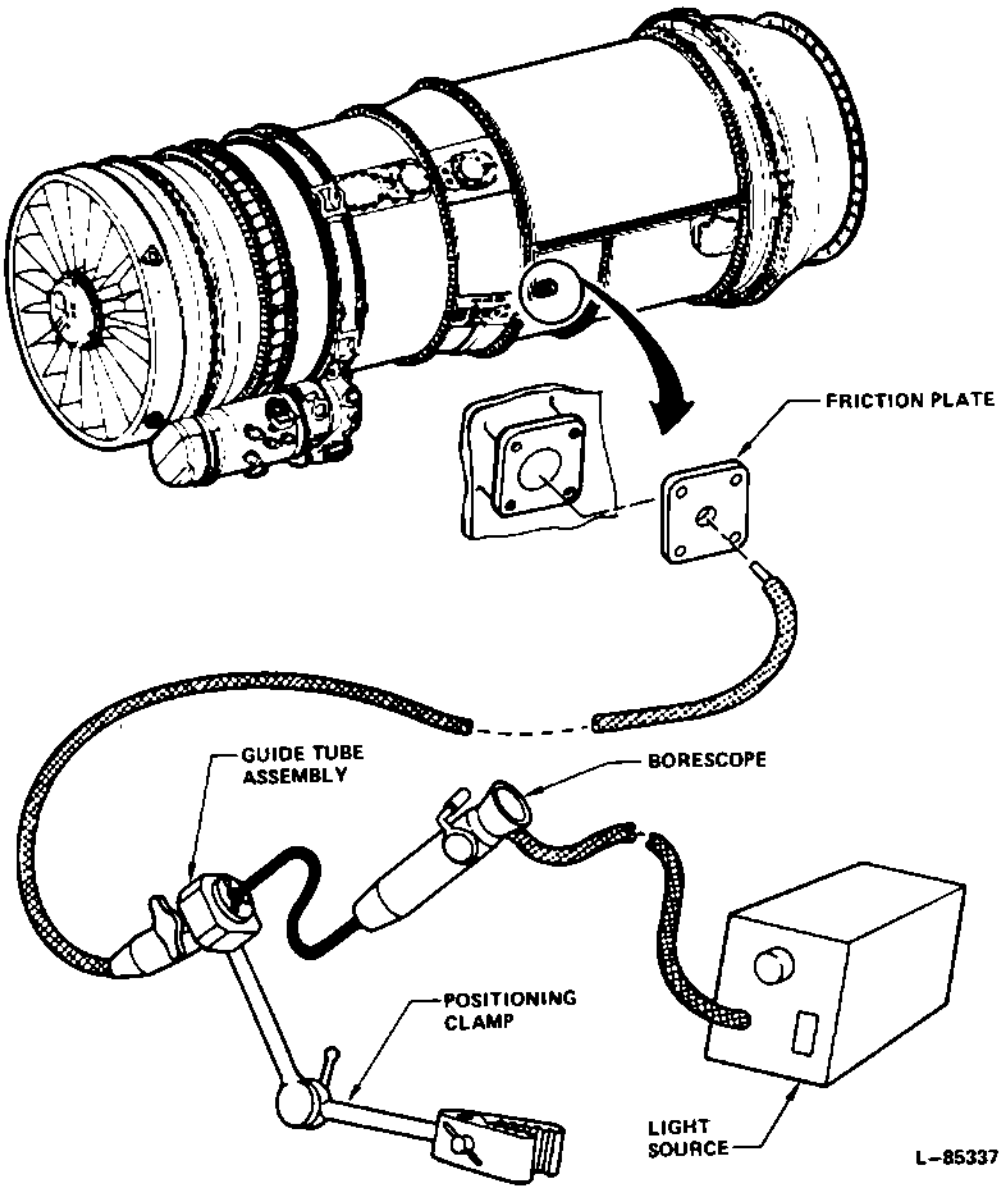
1. 12 By 17 Inch Film
2. 14 By 17 Inch Film
3. Mark 4th Stage Turbine Blade At This Position.
4. 45 Degrees (Turn Rotor In Direction Shown).

Key to Figure 615

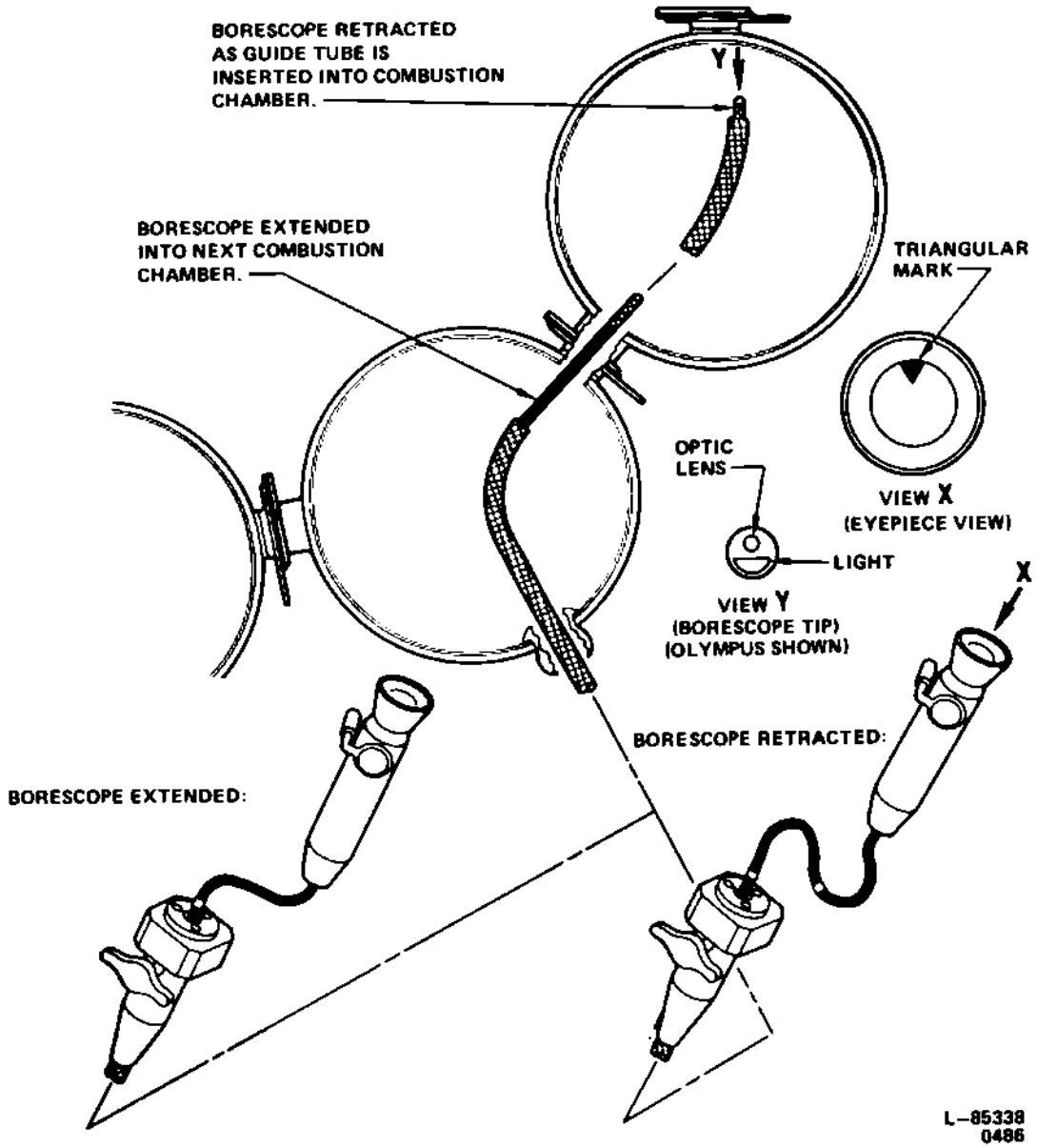

FEMALE CROSSOVER TUBE
MALE CROSSOVER TUBE
VIEW A
TYPICAL CROSSOVER TUBE RELATIONSHIP
(ALL CHAMBERS)
COMBUSTION
CHAMBER
SCHEMATIC
(VIEWED FROM REAR)
LINER NO: 2 3 4 5 6 7 8 9 10 11
MOUNT LUG
CENTERPLANE
0.325
0.900
d
L-85834
0186
LINER LENGTH (INCH)
1.920 1.350 1.350 1.350 1.415 1.535 2.285 2.010 1.250



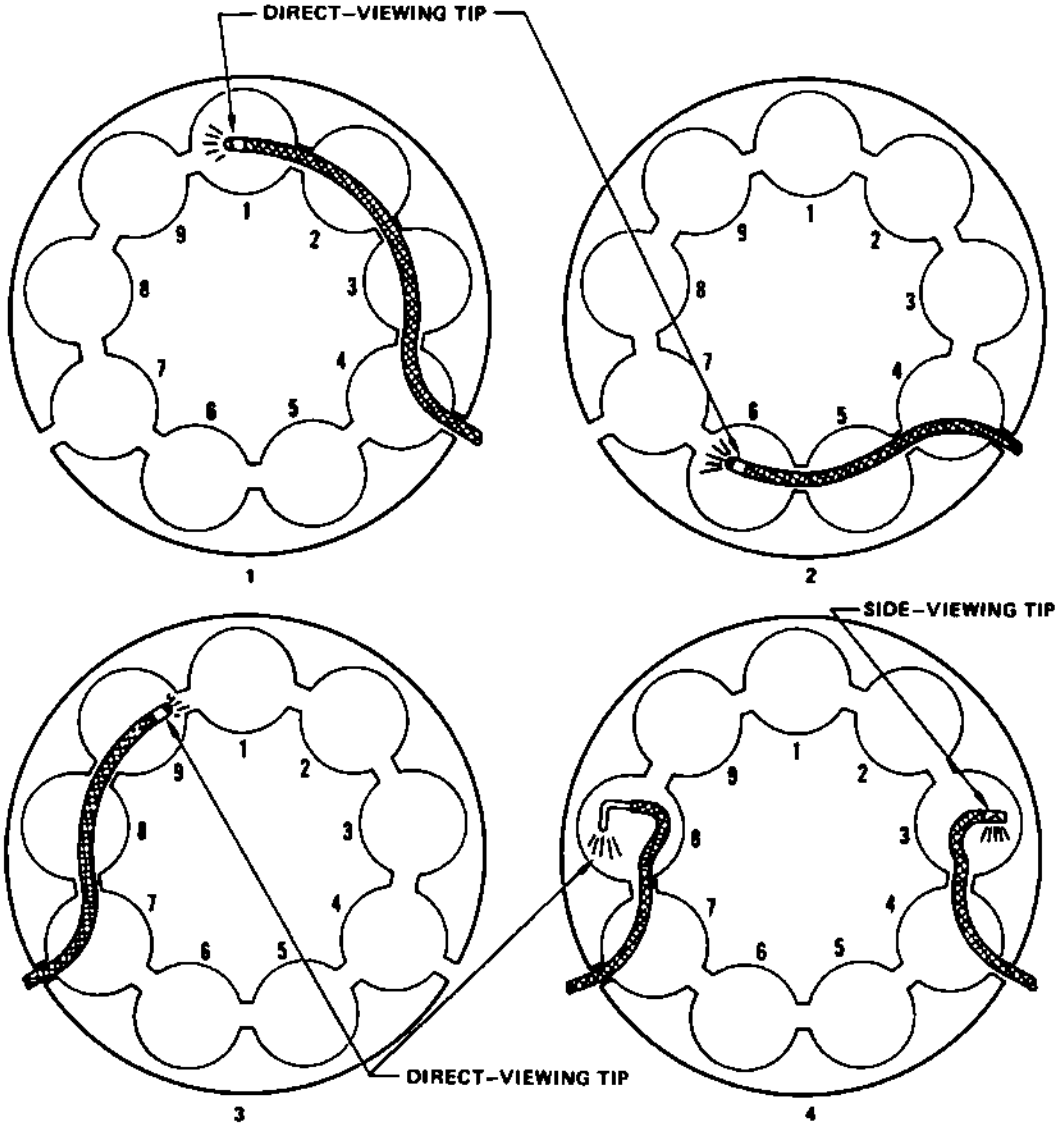
Combustion Chamber
R Borescope Inspection
R Figure 616 (Sheet 2)
(Task 72-00-00-210-020)



Combustion Chamber
R Borescope Inspection
R Figure 616 (Sheet 3)
(Task 72-00-00-210-020)

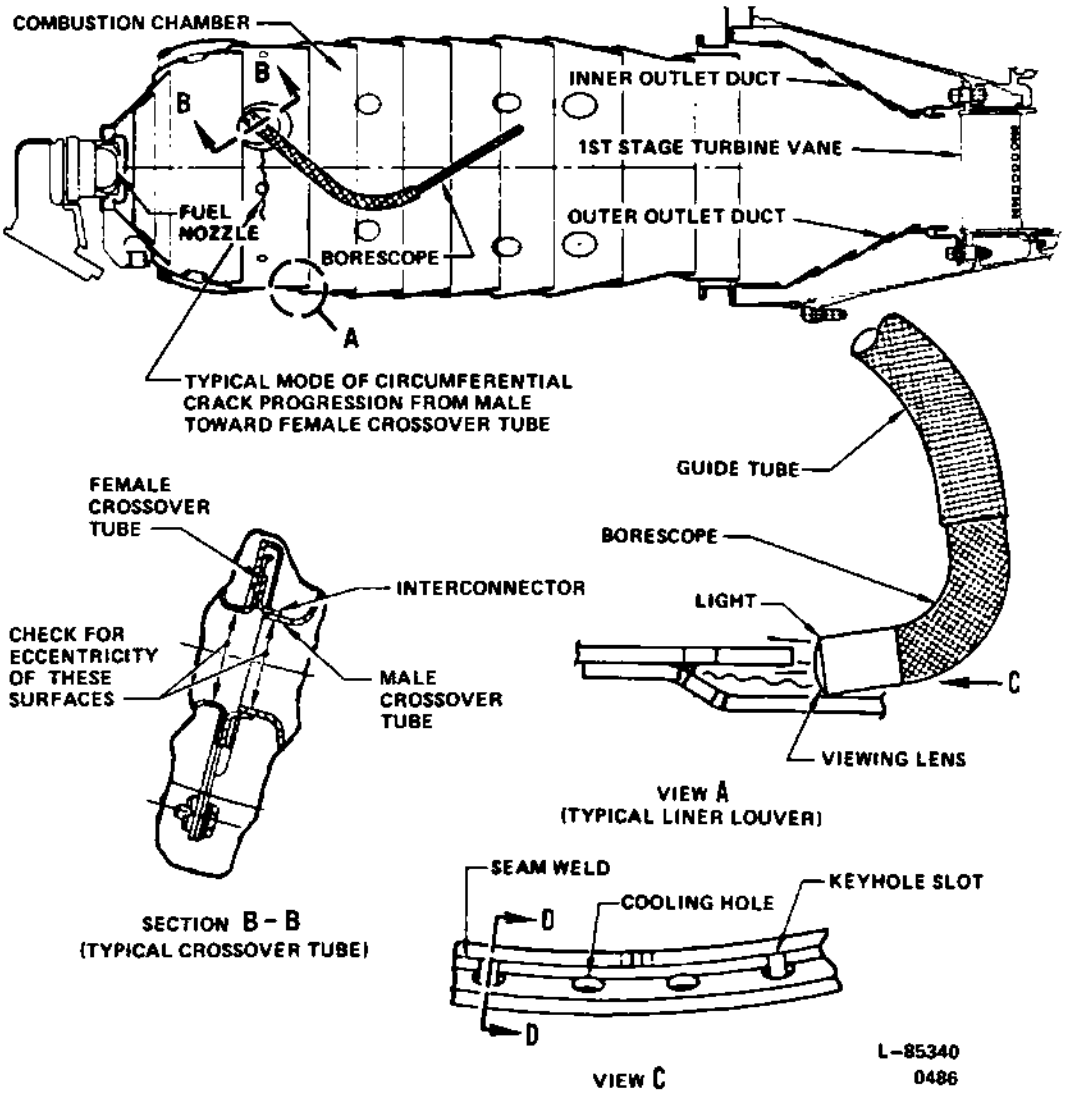


Combustion Chamber
R Borescope Inspection
R Figure 616 (Sheet 4)
(Task 72-00-00-210-020)

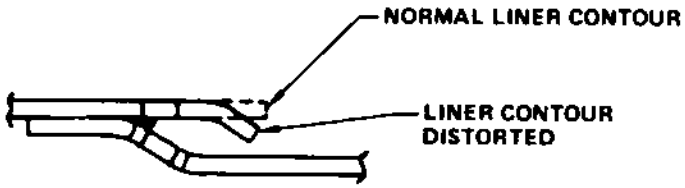


SUGGESTED BORESCOPE INSPECTION SEQUENCE
(AS VIEWED FROM REAR OF ENGINE)

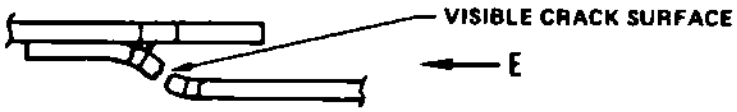
L-85339 (1185)



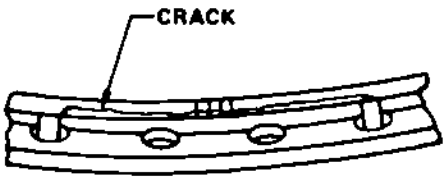
Combustion Chamber
R Borescope Inspection
R Figure 616 (Sheet 6)
(Task 72-00-00-210-020)



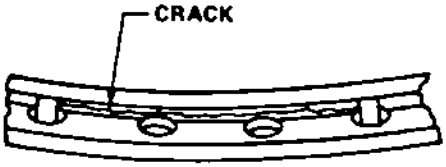
SECTION D–D
(SHOWING INNER LINER DISTORTION WHICH WOULD PREVENT SEAM WELD INSPECTION)



SECTION D–D
(SHOWING OUTER LINER CRACK)

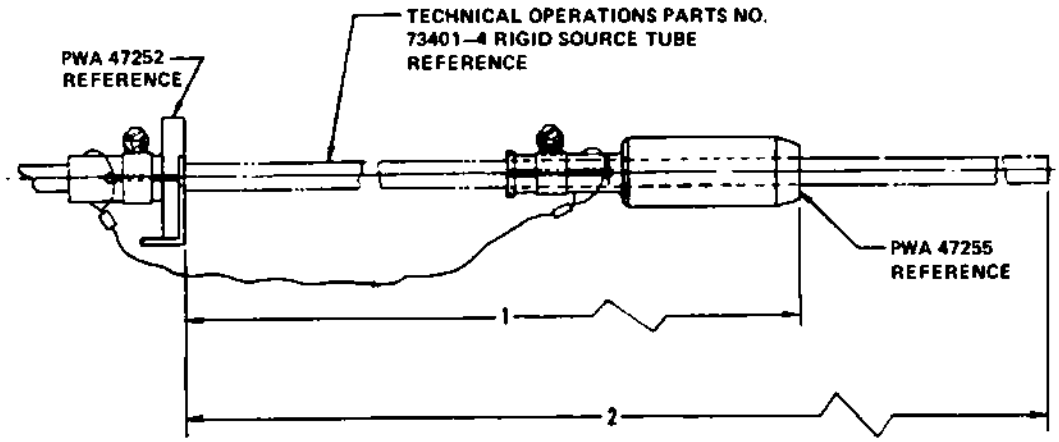


VIEW E
(CRACKED SEAM WELD)

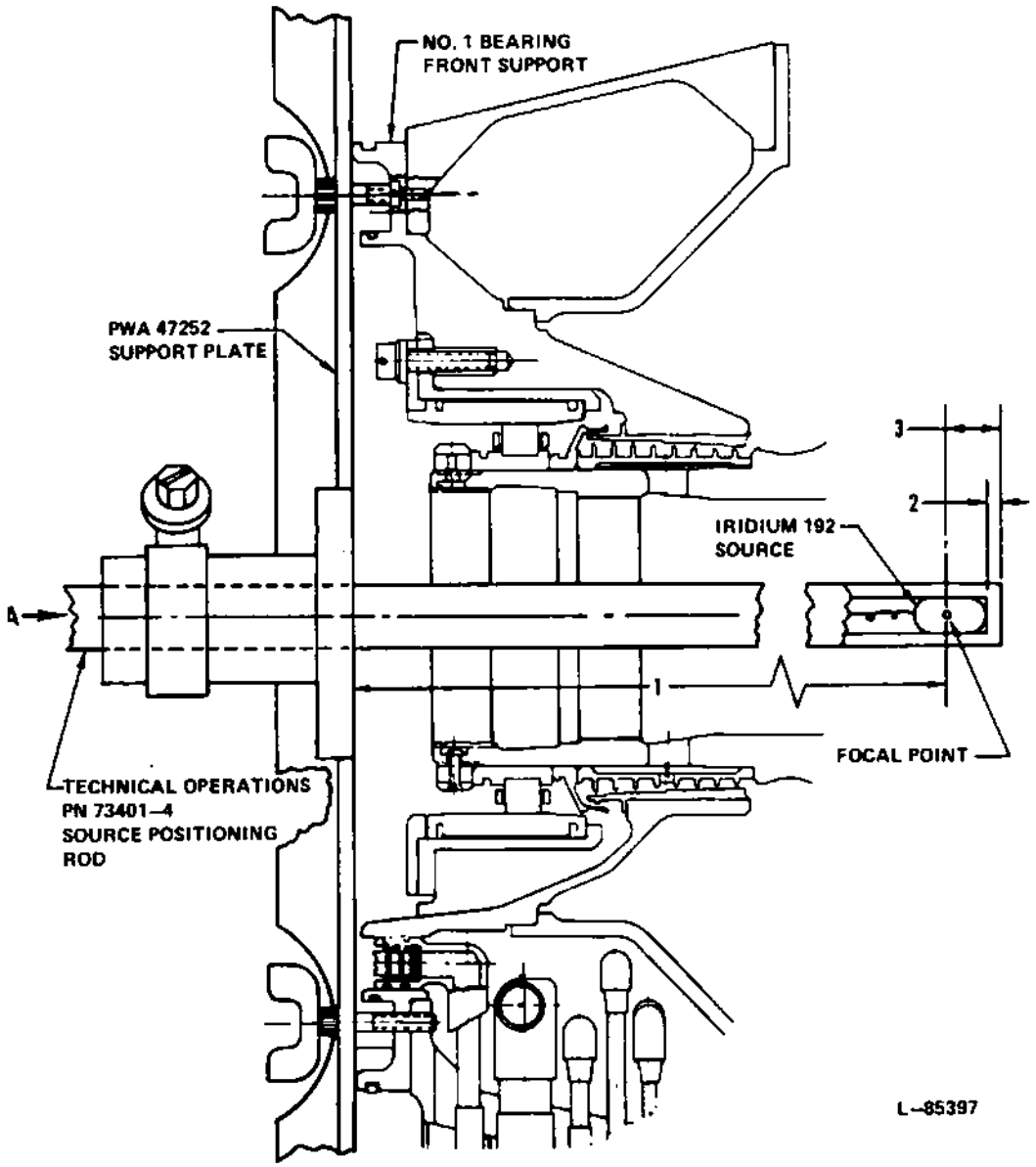


VIEW E
(OUTER LINER CRACKED FORWARD OF COOLING HOLES)

L–86246

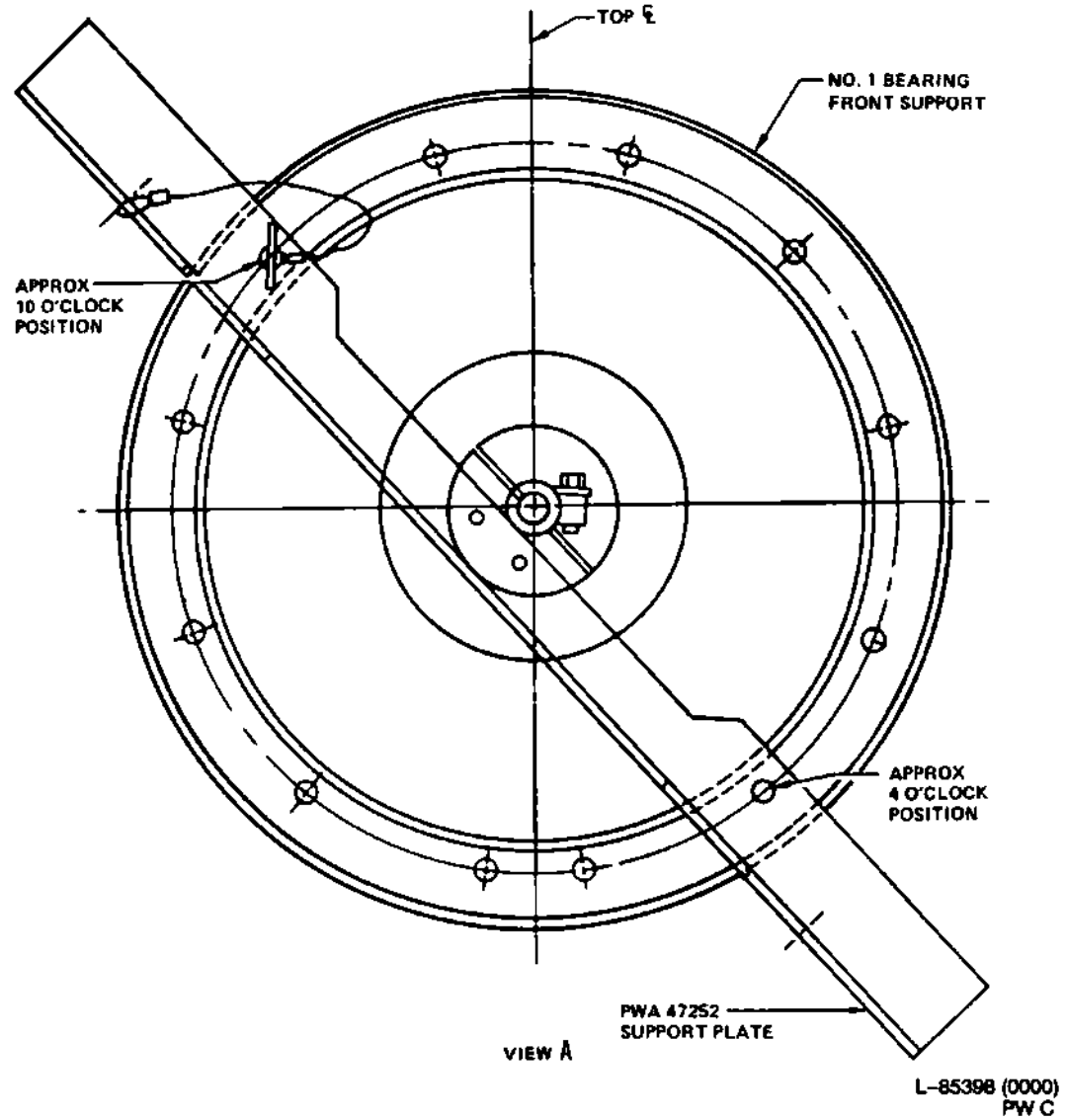


1. 28.000 Inches (711.200 mm)
2. 70.000 Inches (1778.000 mm)

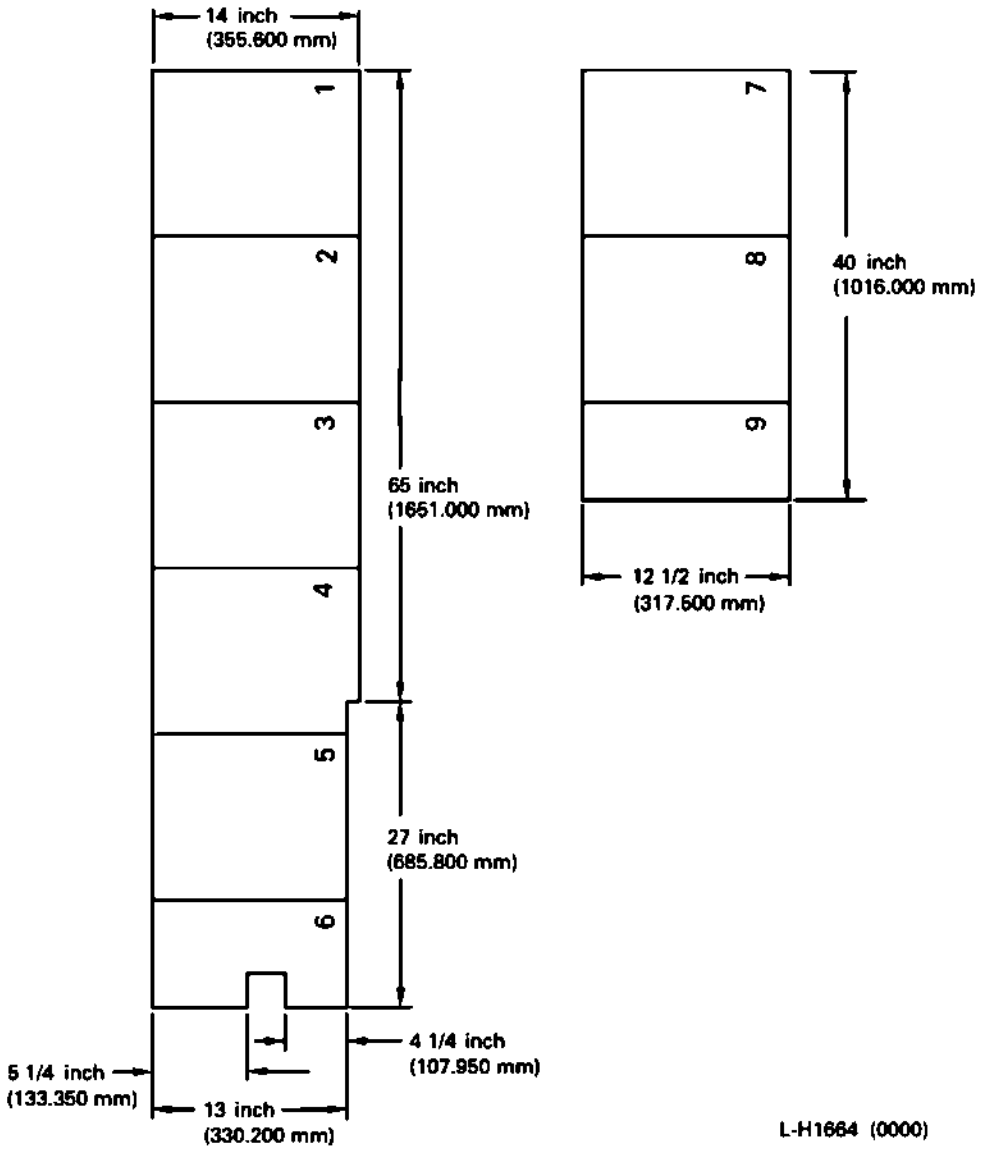


1. 69.6875 Inches (1770.062 mm)
2. 0.125 Inch (3.175 mm)
3. 0.3125 Inch (7.937 mm)

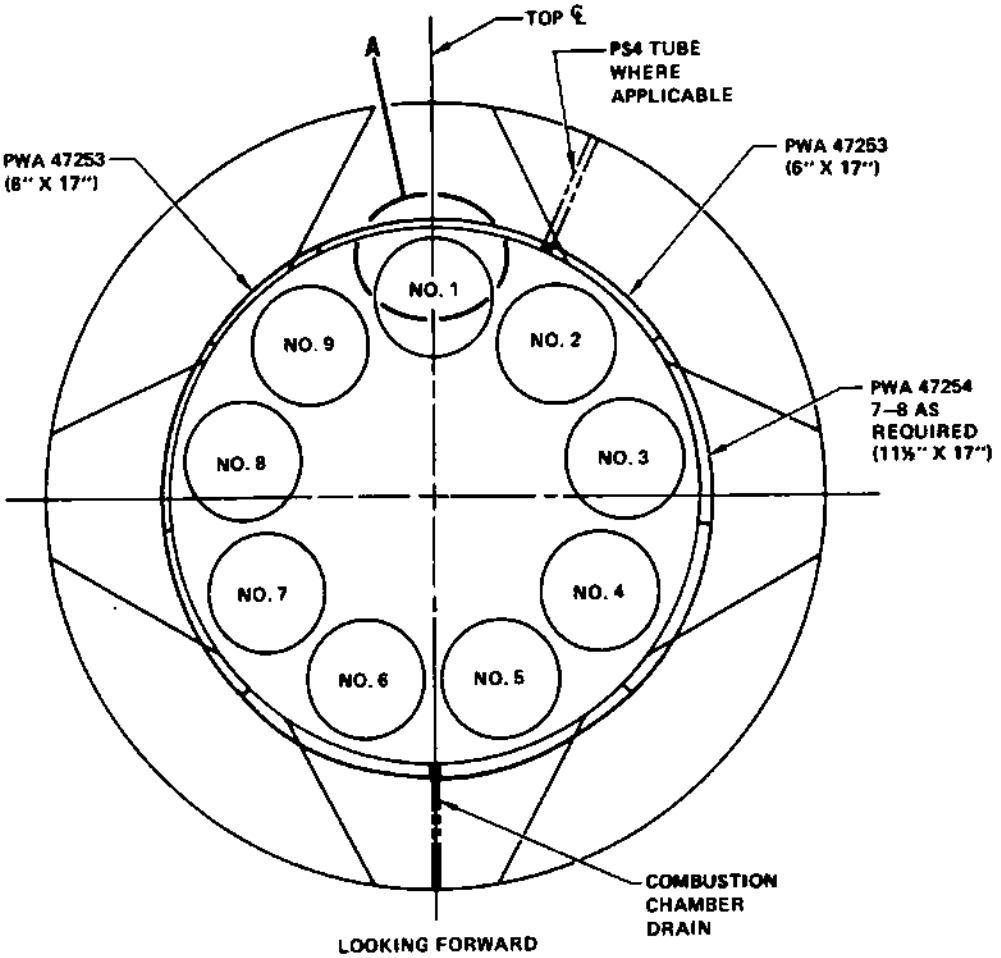
R Insertion Of Rigid Source
R Tube And Position Of Source
Figure 618 (Sheet 1)
(Task 72-00-00-210-020)



Support Plate Location On
R No. 1 Bearing Front Support
R Figure 618 (Sheet 2)
(Task 72-00-00-210-020)

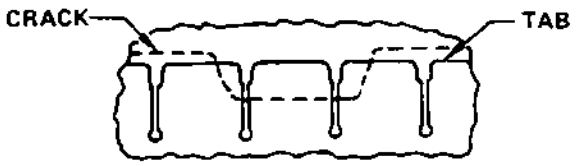


R Film Cut Procedure
R Figure 619
(Task 72-00-00-210-020)



R Paddle/Film Locations
R Figure 620 (Sheet 1)
(Task 72-00-00-210-020)

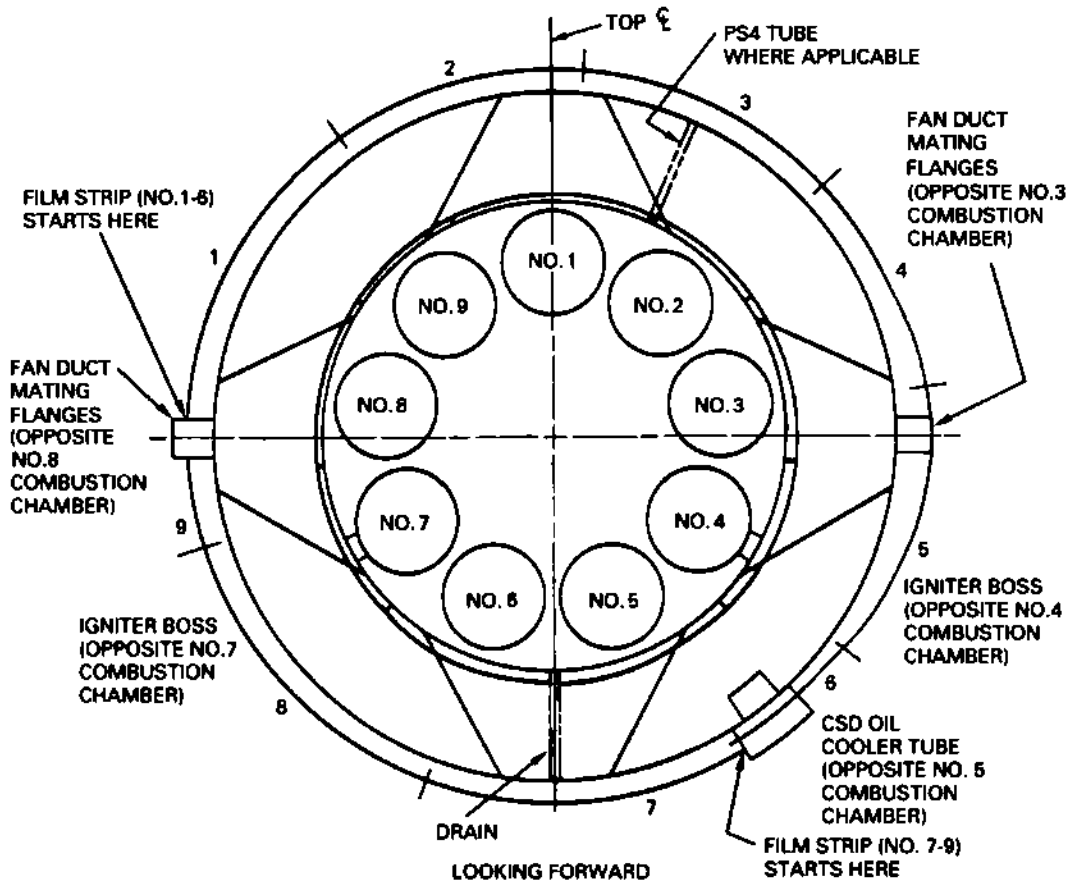
NOTE: BE ALERT FOR CRACKS WHICH RUN ADJACENT TO EXISTING WELDS AND FOR CRACKS WHICH RUN ALONG EDGE OF TABS AND WHICH MAY BE BEHIND EDGE OF TABS BUT ARE VISIBLE BETWEEN TABS.



VIEW OF CRACKS IN TAB AREA

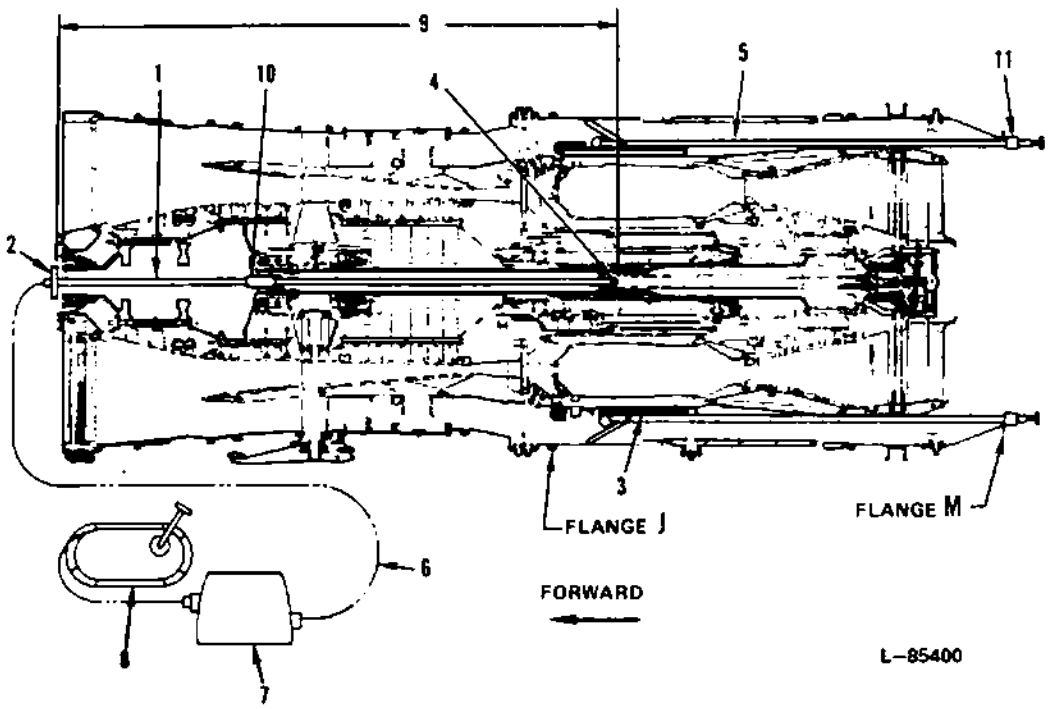
L-85403
0486

Projected Crack
Limit Interpretation
Figure 620 (Sheet 2)
(Task 72-00-00-210-020)



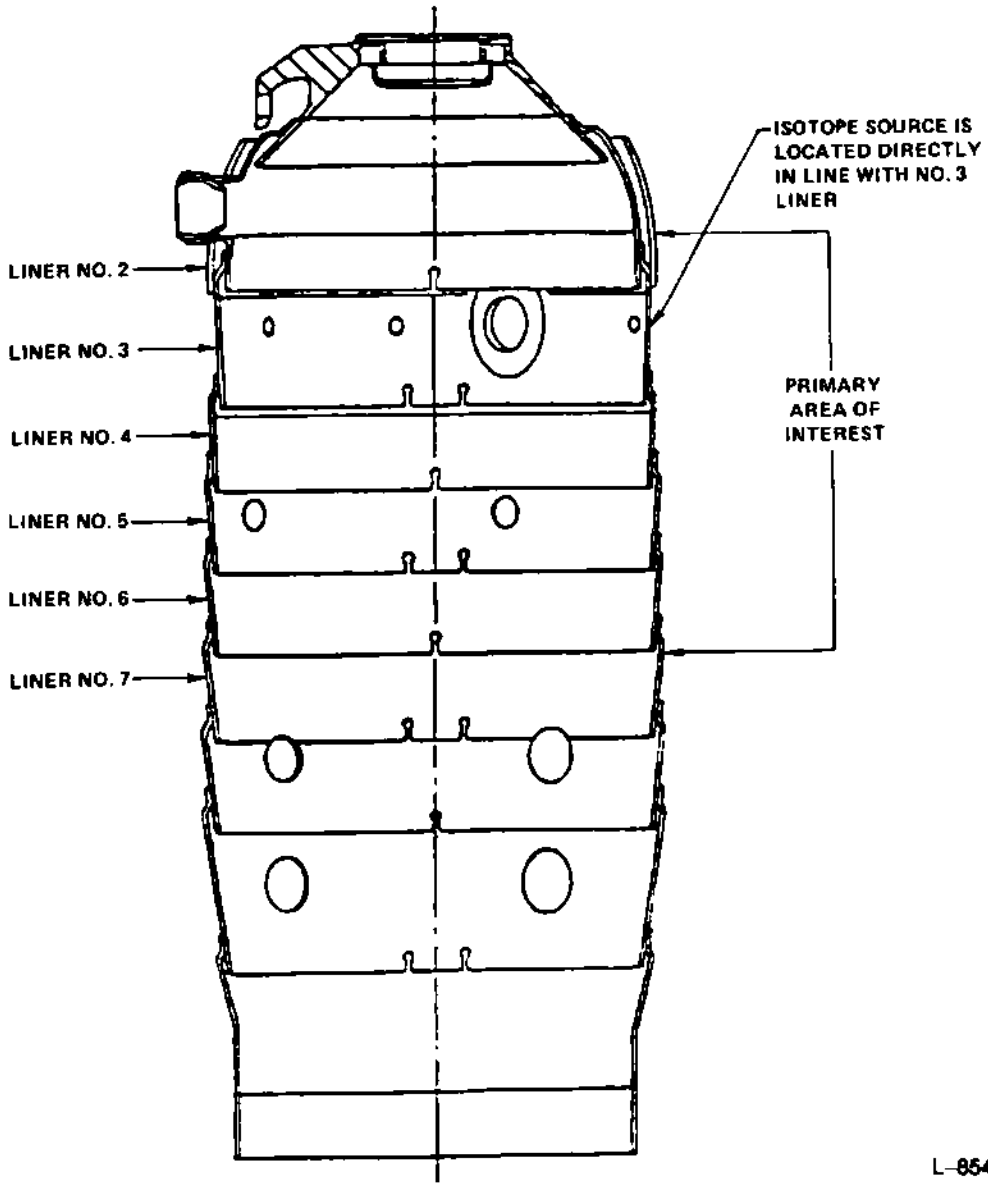
FILM NO.	COMBUSTION CHAMBER NO.
1	8-9
2	9-1
3	1-2
4	2-3
5	3-4
6	4-5
7	5-6
8	6-7
9	7-8

L-H1665 (0000)

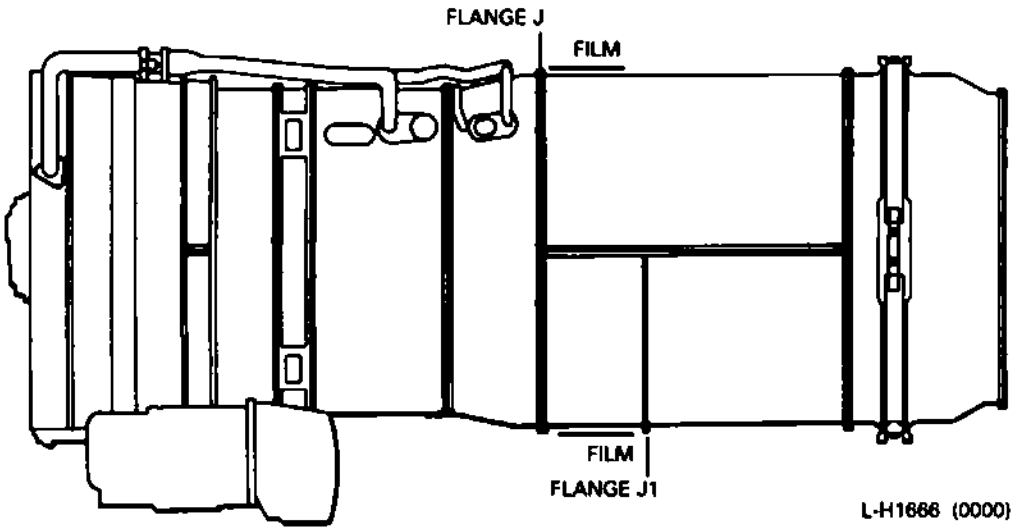


1. Rigid Source Positioning Rod (Technical Operations Inc.)
2. PWA 47252 Support Plate
3. Film
4. Iridium 192 Source
5. PWA 47253 Or PWA 47254 Film Holder Paddle
6. Flexible Source Tube (Technical Operations Inc.)
7. Gamma Ray Projector (Technical Operations Inc.)
8. Gamma Ray Control Assembly (Technical Operations Inc.)
9. 70.000 Inches (1778.000 mm) To End Of Rod
10. PWA 47255 Support Guide Tube
11. Sleeve (Reference)

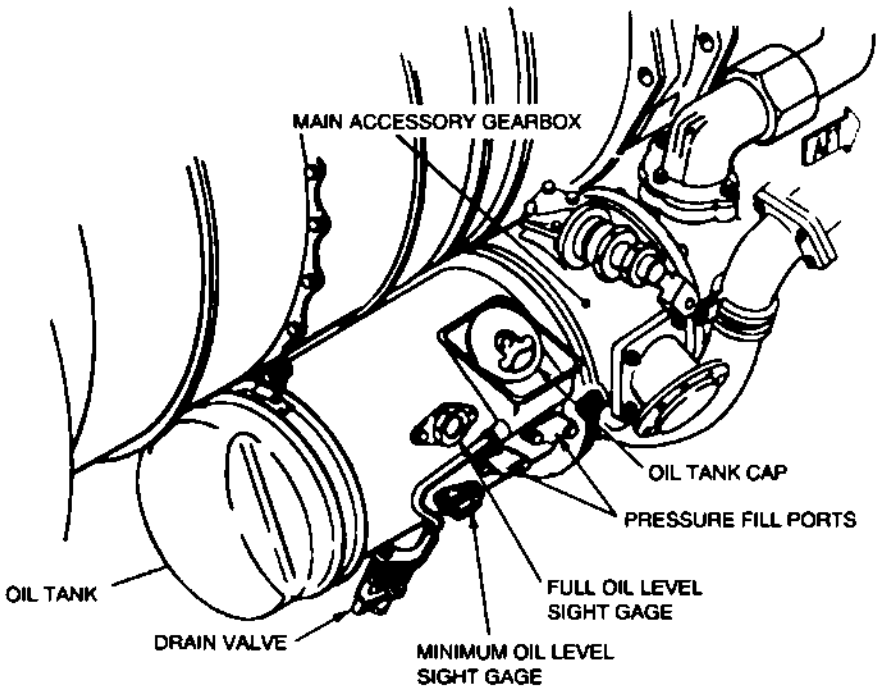
Equipment Position
R For Isotope Procedure
R Figure 621 (Sheet 1)
(Task 72-00-00-210-020)



R Typical Combustion Chamber
R Figure 621 (Sheet 2)
(Task 72-00-00-210-020)

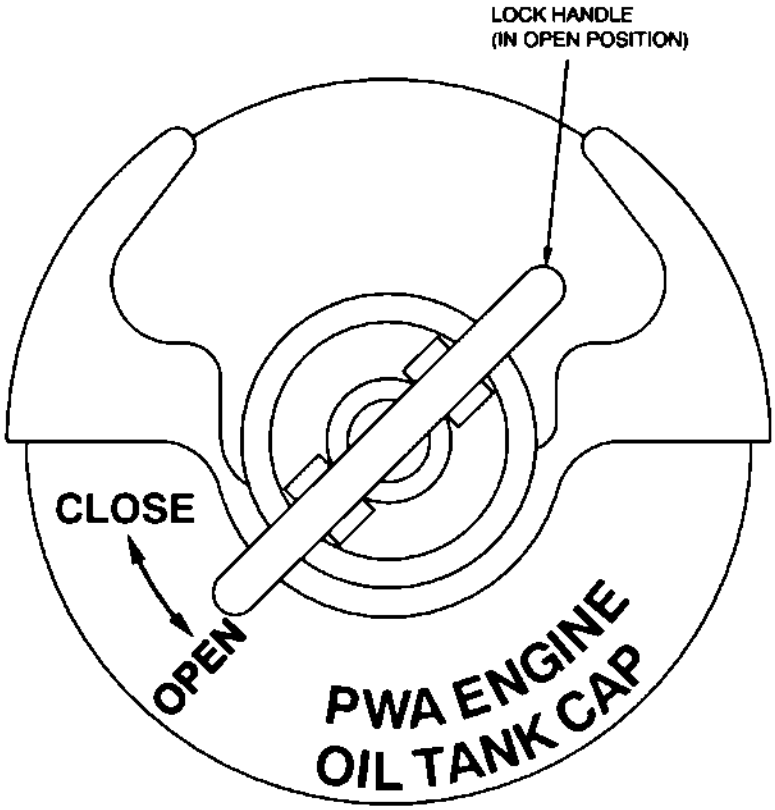


R Film Locations
R Figure 621 (Sheet 3)
(Task 72-00-00-210-020)



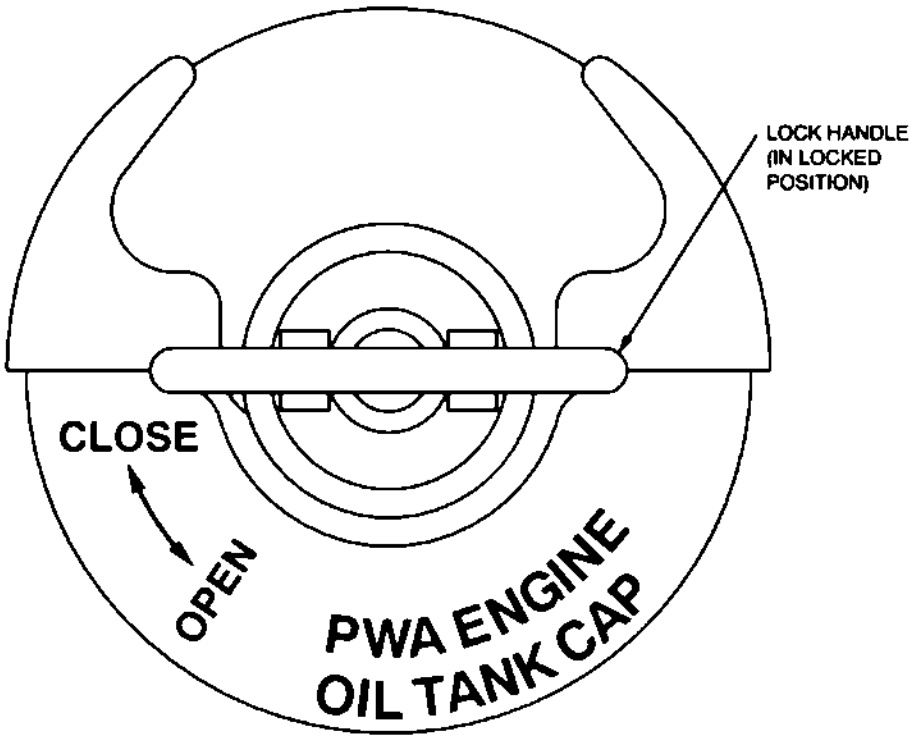
LEFT FRONT VIEW OF ENGINE

L-H4682 (0101)



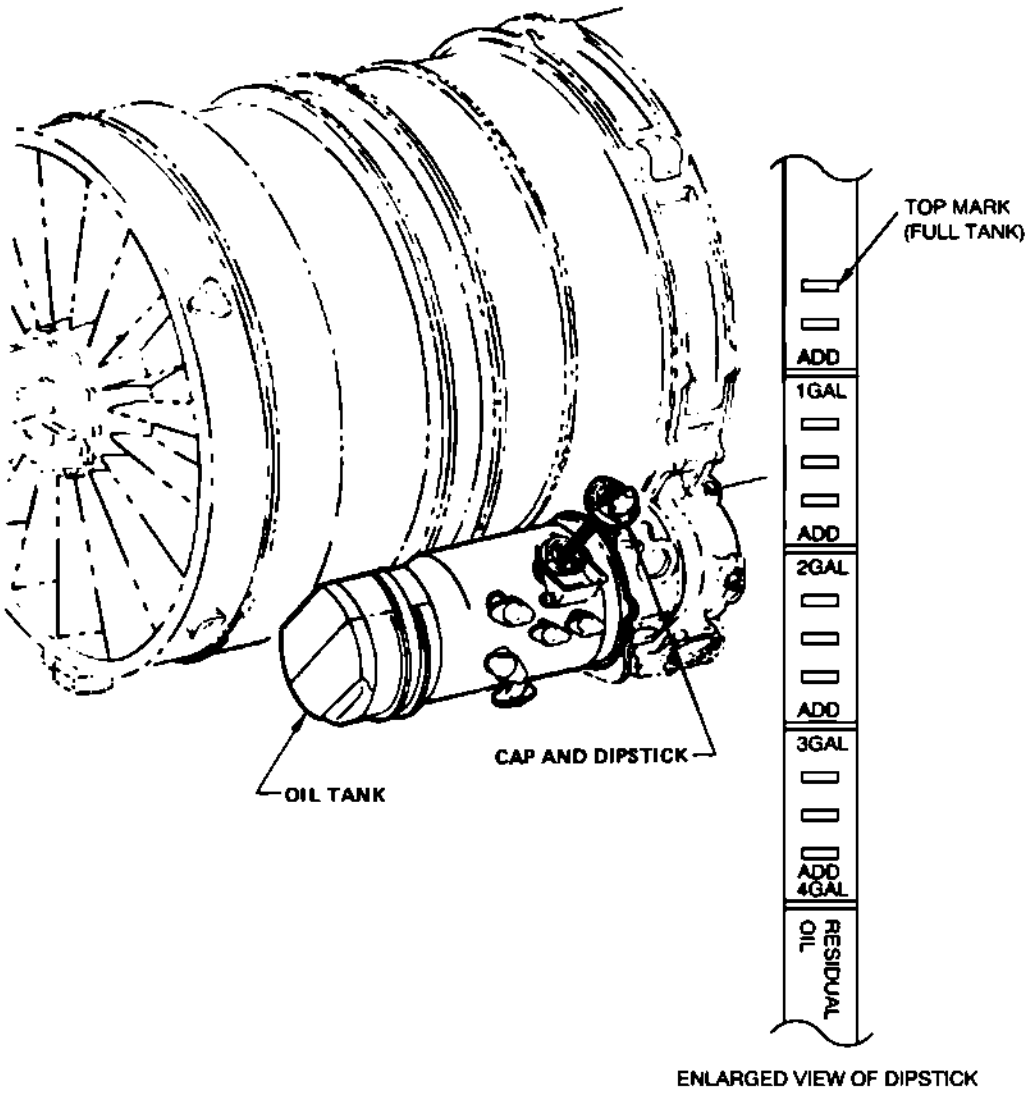
L-H4683 (0101)
PW V

R Oil Tank Cap Removal
R Figure 623
(Task 72-00-00-210-020)

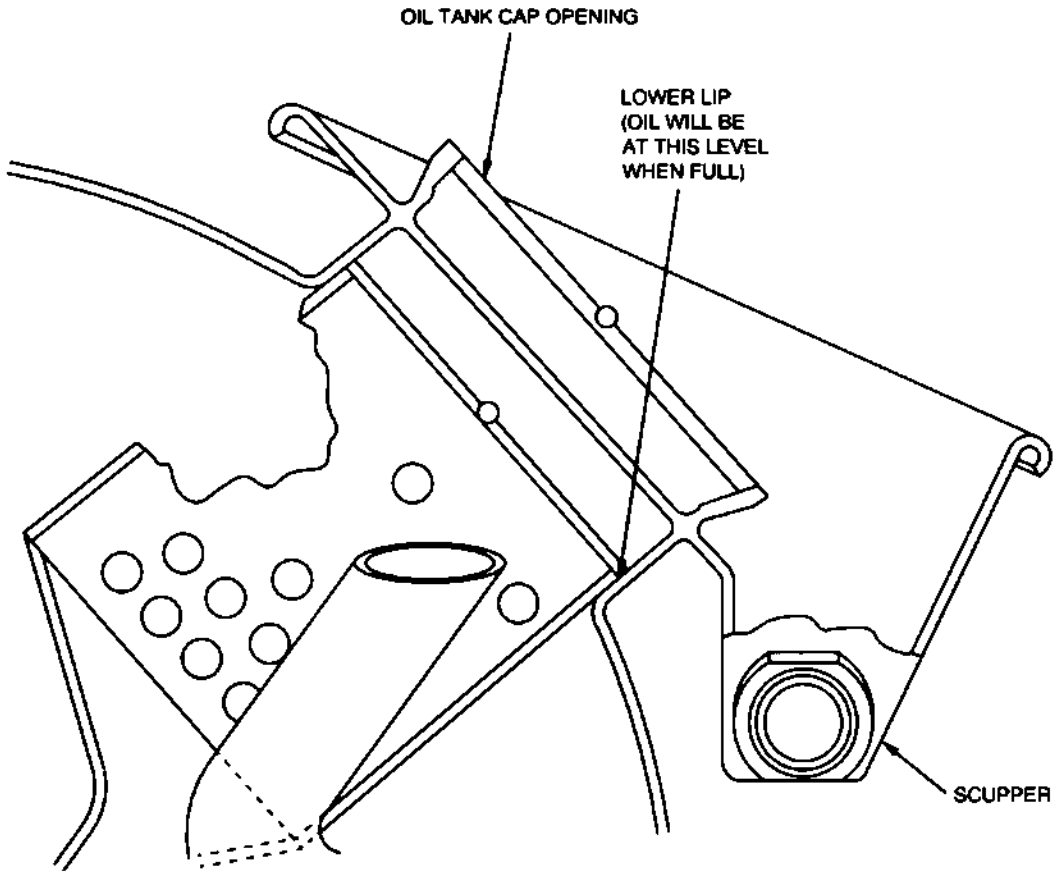


L-H4684 (0101)
PW V

R Oil Tank Cap In Locked Position
R Figure 624
(Task 72-00-00-210-020)



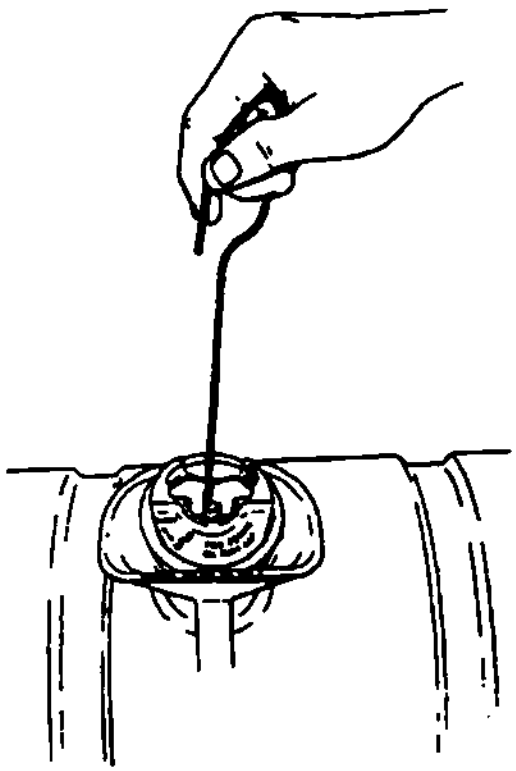
R Oil Tank Cap Dipstick Reading
R Figure 625
(Task 72-00-00-210-020)



CROSS SECTION THROUGH
TANK FILLER NECK

L-H4686 (0101)
PW V

Oil Tank Cap Filler Neck
R Oil Level Visual Check
R Figure 626
(Task 72-00-00-210-020)



L-H4687 (0101)

R Pull Check For Locked Oil Tank Cap
R Figure 627 #72-00-00
(Task 72-00-00-210-020) INSP/CK-01
Page 692M
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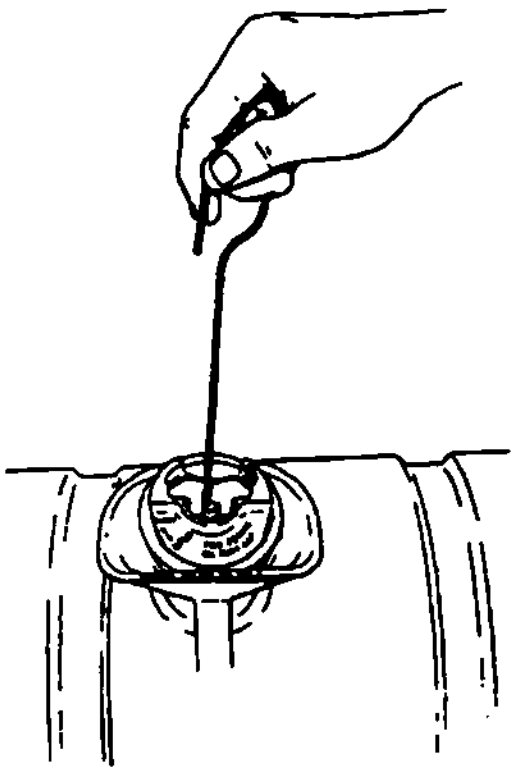
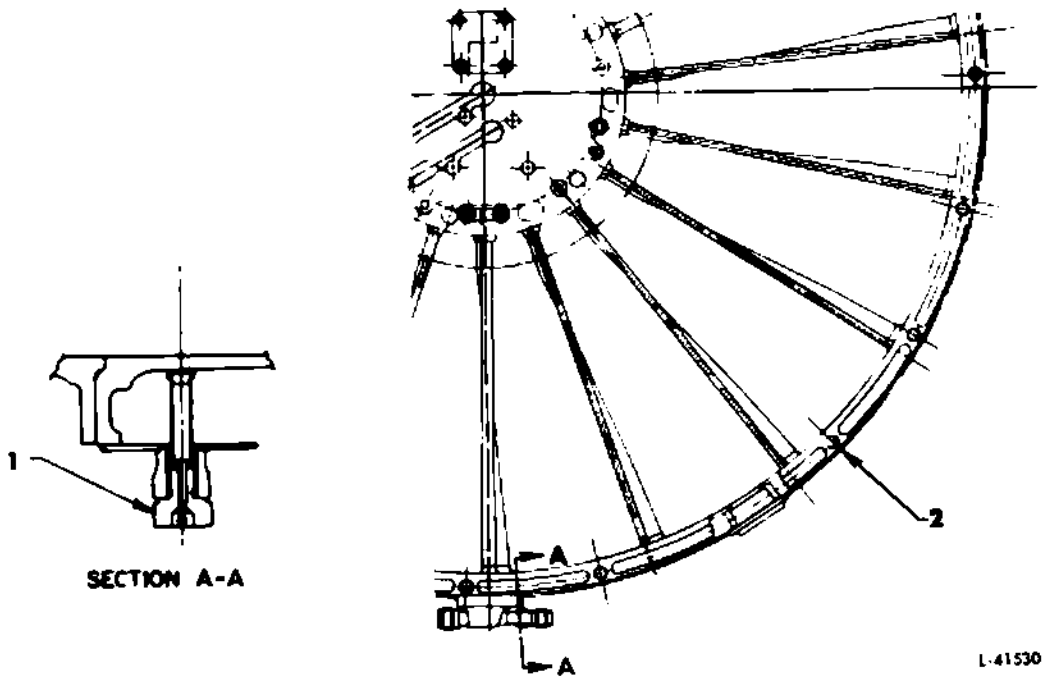


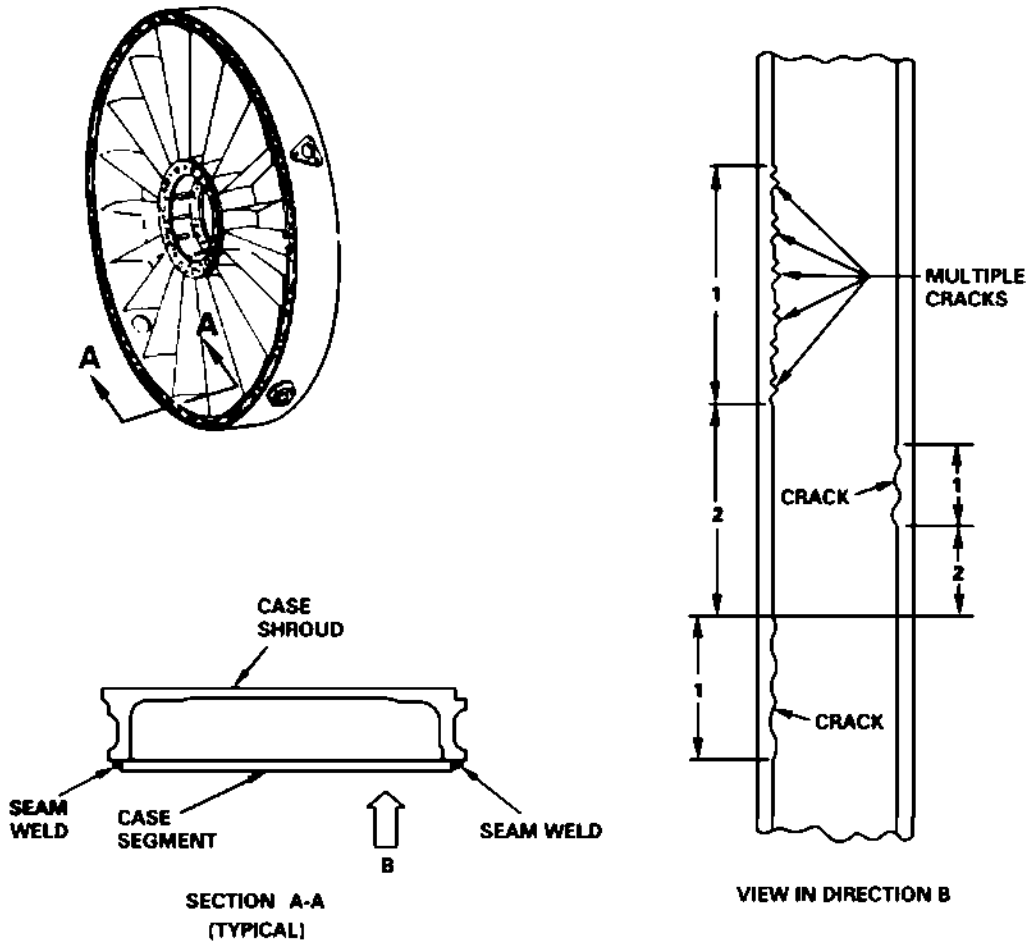
L-H4687 (0101)

Oil Tank Cap In Closed
And Locked Position
Figure 628
(Task 72-00-00-210-020)



1. Vent Plug
2. Fan Inlet Case

R Fan Inlet Case Vent Plug
R Figure 629
(Task 72-00-00-210-020)



1. Crack Length
2. Circumferential Separation

R Fan Inlet Case Seam Weld Cracks
R Figure 630
(Task 72-00-00-210-020)

Task 72-00-00-220-001:

1. Fits and Clearances

A. General

(1) The tables which follow are to be used in conjunction with the figures as referenced.

(2) Reference numbers are used to indicate on the applicable clearance index chart where, in the engine, the tabulated limits apply. Given in the table opposite the reference number are the names of the affected parts, the dimensions of their mating features for reference, the desired minimum and maximum limits for these parts when new, and the limit at which it is necessary to replace worn parts at overhaul. In the descriptive nomenclature "Rear" is toward the exhaust end of the engine and "Front" is toward the opposite end.

B. Terms and Symbols

(1) Unless otherwise specified all fits are diametrical, except spline fits which are calculated from chordal dimensions. Symbols and terms, used in the table, have the following meaning. "T" after a fit denotes a tight fit; a fit without the "T" is a loose fit. "By selection" means parts must be matched by selection. "Fit to" means a fitting operation may be required at assembly to get the required fit. An asterisk "*", indicates parts should be replaced if any looseness is found. The symbol "#", indicates parts should be replaced if scuffing, pitting, galling, or excessive wear of any of the parts has occurred.

C. Units

(1) Values for torque limits shall be interpreted in "pound-inches" and for spring loads in "pounds" only, and all other limits in inches.

D. Torque Application

(1) Unless otherwise specified apply thread lubricants to all parts that are to be torqued. Use PWA 521 engine oil unless otherwise specified. Where torque limits for castle nuts are provided in the minimum column only, these nuts should be tightened to the designated torque, and then further tightened, if necessary, to

properly align the locking slot and hole. Where minimum and maximum values are given, the alignment of the locking slot must be obtained without loosening the nut once it has been tightened and without exceeding the maximum limit. If this is not possible, select another castle nut. Torque requirements for interference fit applications such as studs may be obtained with or without lubrication unless otherwise specified.

E. Disk Life. Limits Are In Engine Manual, Chapter 5-10-00, Time Limits.

F. Applicability Code List

(1) The engine model code letters on the clearance charts appearing under certain configurations represent a code which, in accordance with the manufacturer's records, identify the requirements for certain models only.

(2) Reference to the following table will assist in determining the applicable models involved.

Model Code	Application
JT8D-1 (B)*	Boeing 727
JT8D-1 (B3)*	Boeing 737
JT8D-1 (DS)*	Douglas DC-9
JT8D-1 (F)*	Aerospatiale (Sud Aviation)
JT8D-7 (B2)*	Boeing 727
JT8D-7 (B3)*	Boeing 737
JT8D-7 (DS)*	Douglas DC-9
JT8D-7 (F)*	Aerospatiale (Sud Aviation)
JT8D-9 (B2)*	Boeing 727
JT8D-9 (B3)*	Boeing 737
JT8D-9 (BG2)*	Boeing 727
JT8D-9 (BG3)*	Boeing 737
JT8D-9 (DS)*	Douglas DC-9
JT8D-9 (F)	Aerospatiale (Sud Aviation)
JT8D-9 (JN)*	Nihon C-1
JT8D-11 (BG2)	Boeing 727
JT8D-11 (DS)	Douglas DC-9
JT8D-15 (BG2)	Boeing 727
JT8D-15 (BG3)	Boeing 737
JT8D-15 (DS)	Douglas DC-9
JT8D-15 (DT)	Dassault Mercure
JT8D-17 (BG2)	Boeing 727
JT8D-17 (BG3)	Boeing 737
JT8D-17 (DS)	Douglas DC-9

Model Code	Application
(CONTINUED)	
JT8D-17R (BG2)	Boeing 727
JT8D-17R (BG3)	Boeing 737
JT8D-15A (DS)	Douglas DC-9
JT8D-15A (BG2)	Boeing 727
JT8D-15A (BG3)	Boeing 737
JT8D-17A (DS)	Douglas DC-9
JT8D-17A (BG2)	Boeing 727
JT8D-17A (BG3)	Boeing 737
JT8D-17AR (BG2)	Boeing 727
JT8D-17AR (BG3)	Boeing 737

*Unless otherwise indicated, fits and clearances designated for JT8D-1,-7 or -9 are also applicable to JT8D-1A,-1B, -7A,-7B, or -9A, respectively, in the tables and charts which follow.

G. External Parts
See Figure 601.

(1) Fits and Clearances

REF. NO.	DESCRIPTION	REF. DIMENSIONS MIN	REF. DIMENSIONS MAX	LIMITS MIN	LIMITS MAX	REPLACE IF OVER
1	Thermocouple Lead Band to Clamp			.600	.800	
2	(Pre SB 5872) Bolt-Shoulder	.386	.388			
	Support Assy - Air Shut Off Valve	.390	.392	.002	.006	
3	(Pre SB 5872) Bolt-Shoulder	.386	.388			
	Support Assy - Air Shut Off Valve	.390	.392	.002	.006	
4	Bolt-Shoulder	.310	.312			
	Bushing - Air Shut Off Valve					
	Bracket	.314	.316	.002	.006	.008

REF. NO.	DESCRIPTION	REF. DIMENSIONS MIN	REF. DIMENSIONS MAX	LIMITS MIN	LIMITS MAX	REPLACE IF OVER
5	Bolt - Shoulder	.310	.312			
	Bushing - Anti-Icing Manifold Tube Connector	.314	.316	.002	.006	.007
	Tube Pre-SB 1995	.313	.315	.001	.005	.007
6	Gap: Arm-Fuel Control Connecting Link			.040		
	NOTE: Must be Maintained When A .006 Gage is Applied at "E" After Jam Nut on Connecting Link is Tightened. PN 467057 And 467058 Links With 0.020 Inch Gage			0.006		

(2) Tube Clearances

NOTE: Unless otherwise specified, clearance between tubes (except where clipped together) and also between tubes and other external engine parts must be .125 inch minimum.

REF. NO.	DESCRIPTION	REF. DIMENSIONS MIN	REF. DIMENSIONS MAX	LIMITS MIN	LIMITS MAX	REPLACE IF OVER
7	Gearbox Bracket Compr. Rear Bearing Oil Scavenge Tube			.080		
8	No. 6 Bearing Rear Pressure Tube Coupling Fan Exhaust Duct			.030		
9	Anti-Icing Manifold Bleed Control Tube			.110		

REF. NO.	DESCRIPTION	REF. DIMENSIONS MIN	REF. DIMENSIONS MAX	LIMITS MIN	LIMITS MAX	REPLACE IF OVER
10	Front Anti-Icing Air Tube Elbow Fan Inlet Case			.090		
11	Anti-Icing Tube Assembly (LH & RH Side) Rear Compr. Fan Duct			.070		
12	No. 4 Bearing Scavenge Tube - Oil Cooler Inlet Tube Elbow			.060		
13	Gearbox Bracket Scavenge Tube			.080		

(3) Torque Values

REF. NO.	DESCRIPTION	MIN	MAX	REPLACE
101	Nut-Oil Pressure Manifold Coupling	130	140	
102	Nut-Oil Cooler Inlet Tube Coupling	130	140	
103	Nut - No. 1 Bearing External Breather Tube Coupling (Both Ends)	110	120	
104	Nut-No. 4 Bearing Breather Tube Coupling	200	220	
105	Nut-Compressor Rear Bearing External Oil Scavenge Tube Coupling	130	140	
106	Nut-Alumel Thermocouple Lead Attachment (.190-32)	15	18	
107	Nut-Oil Pressure Manifold Coupling	110	120	

REF. NO.	DESCRIPTION	MIN	MAX	REPLACE
108	Nut-Chromel Thermocouple Lead Attachment (.164-32)	12	15	
	NOTE: Proper installation of locknuts Ref. No. 106 and 108 requires that the cylindrical grooved portion of the nut must lead the way onto the stud.			
109	Nut - Ps3 Bleed Control Tube Coupling	110	120	
110	Nut-Inner Alumel and Chromel Thermocouple Lead Attachments at Junction Box	20	25	
111	Nut-Outer Alumel Stud at Junction Box	18	22	
112	Nut-Outer Chromel Studs at Junction Box	15	18	
113	Electrical Connectors AN 3100 Thru AN 3108			
	NOTE: Torque Fingertight and further tighten 45° Max.			
114	Cigarette Type Electrical Connections			
	NOTE: Shoulder "A" Must Bottom on Mating Part (Approx. 140-160 LB-IN.)			
115	Filter Cover Nut (Fuel Pump)	75	100	
117	Flowmeter Adapter Outlet Tube Connector	570	630	
118	Nut-Inner Alumel Stud At Junction Box	40	45	
119	Nut-Outer Alumel Stud At Junction Box	35	40	
120	Nut-Inner Chromel Thermocouple Lead Attachments At Junction Box	20	25	

REF. NO.	DESCRIPTION
200	Shut Off Lever Adjustment:

1. Place fuel control shut off lever against off stop (full ccw).

2. Adjust Fuel control shut off lever at the stop position to obtain 26° 41' ± 0" 30' angle at "C".

3. Adjust cross shaft shut off lever to obtain 26° 41' ± 0° 30' angle at "D".

4. Adjust connecting link so it can be installed without moving either lever from the above positions or moving control from ccw stop position.

5. To prove alignment after installing the connecting link insert a .015 thick gauge between the fuel control shut off lever and its stop when the lever is rotated counterclockwise and insert a .246 - .248 diameter pin thru the hole at the end of the cross shaft shut off lever and into the hole of the gearbox mounted bracket. If necessary loosen the nuts that hold the bracket to the gearbox and move the bracket within the clearance of the stud holes. If the pin will not fit into the bracket, steps 1 thru 4 must be repeated.

201 Power Lever Adjustment:

1. Place fuel control power lever at idle index position.

2. Adjust fuel control power lever at idle index position to obtain 10° 20' ± 0° 30' angle at "A".

3. Adjust cross shaft power lever to obtain 12° 40' ± 0° 30' angle at "B".

4. Adjust connecting link so it can be installed without moving either lever from the above positions or moving control from idle index position.

REF. NO. DESCRIPTION

202 Procedure For Installing Cap on Flowmeter Adapter Inlet Tube Connector:

1. Coat packing, packing retainer and external thread of fitting sparingly with petrolatum spec VV-P-236 (vaseline) or fluid to be used in line and assemble nut, packing retainer and packing onto fitting as shown. Work packing retainer into C bore of nut. Turn nut down until packing is pushed firmly against first lower thread of fitting.

2. Install cap onto fitting until cap contacts packing as shown (recognized by sudden torque increase) while holding nut stationary turn cap to obtain metal-to-metal contact between cap and nut without exceeding recommended torque. Extrusion of packing or packing retainer not permissible.

203 Typical Nut and Tab Lock Assembly Procedure:

Position Part "C" against Part "B". Tighten finger tight then back off one half turn and bend tabs of Part "D". Thread engagement between Parts "C" and "E" must be such that a No. 60 wire will not pass thru the .063 dia hole (both walls) in part "C".

204 Trim Balance Plane: (Reference) (See Adjustment/Test)

205 Trim Balance Plane: (Reference) (See Adjustment/Test)

H. Engine Assembly Fits and Clearances
See Figure 602.

(1) Fits and Clearances

REF. NO.	DESCRIPTION	REF. DIM. MIN	REF. DIM. MAX	LIMITS MIN	LIMITS MAX	REPLACE IF OVER
1	Hub-Front Compr., Front	3.7422	3.7429			
	Bearing-Roller, No. 1	3.7399	3.7402	.002T	.003T	

REF. NO.	DESCRIPTION	REF. DIM. MIN	REF. DIM. MAX	LIMITS MIN	LIMITS MAX	REPLACE IF OVER
2	Hub-Front Compr., Front Slinger-No. 1 Bearing	3.7495 3.7490	3.7500 3.7505	 .001T	 .001	
3	Hub-Front Compr, Front Seal-No. 1 Bearing	3.7495 3.7485	3.7500 3.7500	 .0015T	 .0005	
	Seal-No. 1 Bearing (Prior To Change Letter A)	3.7490	3.7505	.001T	.001	
4	Hub-Front Compr, Front Seal-No. 1 Bearing	3.7595 3.7570	3.7600 3.7585	 .001T	 .003T	
5	Non-Oil-Damped Bearing Type: No. 1 Bearing Seal-Ring (Diameters Listed Front to Rear)					
	Seal	4.488	4.490			
	Ring	4.499	4.504	.009	.016	
	Seal	4.468	4.470			
	Ring	4.479	4.484	.009	.016	
	Seal	4.448	4.450			
	Ring	4.459	4.464	.009	.016	
	Seal	4.428	4.430			
	Ring	4.439	4.444	.009	.016	
	Seal	4.408	4.410			
	Ring	4.419	4.424	.009	.016	
	Seal	4.388	4.390			
	Ring	4.399	4.404	.009	.016	
	Seal	4.368	4.370			
	Ring	4.379	4.384	.009	.016	
	Seal	4.348	4.350			

R
R

	REF. NO.	DESCRIPTION	REF. DIM. MIN	REF. DIM. MAX	LIMITS MIN	LIMITS MAX	REPLACE IF OVER
		(CONTINUED)					
		Ring	4.359	4.364	.009	.016	
		Oil-Damped Bearing Type No. 1 Bearing Seal-Ring (Diameters Listed Front to Rear)					
		Seal	4.488	4.490			
		Ring	4.504	4.509	.014	.021	
		Seal	4.468	4.470			
		Ring	4.484	4.489	.014	.021	
		Seal	4.448	4.450			
		Ring	4.464	4.469	.014	.021	
		Seal	4.428	4.430			
		Ring	4.444	4.449	.014	.021	
		Seal	4.408	4.410			
		Ring	4.424	4.429	.014	.021	
		Seal	4.388	4.390			
		Ring	4.404	4.409	.014	.021	
		Seal	4.368	4.370			
		Ring	4.384	4.389	.014	.021	
		Seal	4.348	4.350			
		Ring	4.364	4.369	.014	.021	
	6	Axial Clearance Seal Ring- No. 1 Bearing	.0935	.0945			
R		Bearing	.0955	.1005	.001	.007	.007
	7	Non-Oil-Damped Bearing No. 1 Bearing Housing	5.3146	5.3150			
			5.3150	5.3157	.0000	.0011	
		Oil-Damped Bearing No. 1 Bearing Housing	5.5566	5.5580			
			5.5647	5.5659	.0067	.0093	

REF. NO.	DESCRIPTION	REF. DIM. MIN	REF. DIM. MAX	LIMITS MIN	LIMITS MAX	REPLACE IF OVER
8	Ring Gap Seal Ring- No. 1 Bearing Gap .032 - .042 at 5.5656 Gage Dia Housing	5.5647	5.5659	.029	.043	.043
9	Case-Fan	40.753	40.759			
	Shroud-Compr. Stator Inlet	40.747	40.753	.000	.012T	
19	Shroud-Compressor Stator 4th Stage	28.848	28.852			
	Flange-Compr. Case	28.850	28.856	.002T	.008	
21	Case-Fan Exit	40.606	40.612			
	Case-Fan	40.600	40.606	.000	.012T	
22	Duct-Fan, Front Compr.	39.753	39.759			
	Case-Fan Exit	39.747	39.753	.000	.012T	
58	Nut-Fuel Nozzle, Assy of	1.524	1.526			
	Combustion Chamber, Assy of	1.534	1.540	.008	.016	
59	Pin-Combustion Chamber	.3725	.3735			
	Combustion Chamber, Assy of	.3745	.3755	.001	.003	
59	Combustion Chambers, Having Cobalt Alloy Pin Hole Sleeve Bushings (Ref. PN 733205, 740415)	.3755	.3765	.002	.004	
	Combustion Chambers, Having					

REF. NO.	DESCRIPTION	REF. DIM. MIN	REF. DIM. MAX	LIMITS MIN	LIMITS MAX	REPLACE IF OVER
(CONTINUED)						
	Hardfaced Pin Hole Sleeve Bushings (Ref. PN 748287, 748295)	.3755	.3775	.002	.005	
60	Case-Diffuser, Assy of	31.343	31.349			
	Case-Combustion Chamber, Outer, Assy of	31.337	31.343	.000	.012T	
61	Duct Assy-Fan Rear Compr.	39.064	39.072			
	Duct Assy-Fan, Diffuser, Outer	39.060	39.064	.000	.012T	
62	Seat-Sealing Fuel Manifold Inlet Tube Inner	3.351	3.352			
	Duct Assy-Fan, Diffuser, Outer (Duct Post-SB 1011)	3.3525	3.3535	.0005	.0025	
62-1	See Section 73-13-1, Fuel Nozzle and Support, Removal/ Installation					
63	Duct Assy-Fan Diffuser, Outer	40.916	40.920			
	Duct-Fan, Combustion Chamber & Turbine, Assy of	40.908	40.916	.000	.012T	
83	Cover No. 6 Bearing	6.838	6.840			
	Housing	6.841	6.843	.001	.005	.007

REF. NO.	DESCRIPTION	REF. DIM. MIN	REF. DIM. MAX	LIMITS MIN	LIMITS MAX	REPLACE IF OVER
88	JT8D-1,-1A,-1B, -7,-7A,-7B,-9, -9A: Smoke Reduced Combustion Chamber With Hardfacing: Male Crossover Tube	1.277	1.285			
	Interconnector Tube	1.295	1.301	.010	.024	
	Smoke Reduced Combustion Chamber Without Hardfacing: Male Crossover Tube	1.273	1.277			
	Interconnector Tube	1.289	1.295	.012	.022	
	Non-Smoke Reduced Combustion Chamber With Hardfacing: Male Crossover Tube	1.004	1.012			
	Interconnector Tube	1.053	1.065	.041	.061	
	Non-Smoke Reduced Combustion Chamber Without Hardfacing: Male Crossover Tube	1.000	1.004			
	Interconnector Tube	1.061	1.069	.057	.069	
	JT8D-11: Bolted Interconnector Combustion					

REF. NO.	DESCRIPTION	REF. DIM. MIN	REF. DIM. MAX	LIMITS MIN	LIMITS MAX	REPLACE IF OVER
	Chamber Without Hardfacing:					
	Male Crossover Tube	1.273	1.277			
	Interconnector Tube	1.289	1.295	.012	.022	
	JT8D-11,-15,-17, -17R: Floating Interconnector With Hardfacing Combustion Chambers Male Crossover Tube	1.279	1.283			
	Tube-Combustion Chamber Interconnector	1.289	1.295	.006	.016	
	Floating Interconnector Without Hardfacing Combustion Chambers Male Crossover Tube	1.273	1.277			
	Combustion Chamber Interconnector Tube	1.283	1.289	.006	.016	.030
	JT8D-11,-15,-15A, -17,-17A,-17R, -17AR: Bolted Interconnector Combustion Chamber With Hardfacing Male Crossover Tube	1.279	1.287			
	Interconnector Tube	1.295	1.301	.008	.022	

	REF. NO.	DESCRIPTION	REF. DIM. MIN	REF. DIM. MAX	LIMITS MIN	LIMITS MAX	REPLACE IF OVER
	89	Gap Valve Assy-Fuel Drain			.023	.050	
	96	Axial Fit No. 1 Bearing Outer Race To					
R		Retaining Plate			.0005	.007	.007
	97	Side Clearance Bearing-Roller, No. 1	.360	.364			
R		Plate-Retaining	.376	.380	.012	.020	.070
	99	Ring Gap Seal Ring-Rear Bleed Manifold Gap .015-.040 at 3.200 Gap Dia Liner (Seal Ring					
		Prior To PN 770184)	3.200	3.202	.015	.046	
		Seal Ring (PN 770184)	3.200	3.202	.004	.018	
	100	Side Clearance Seal Ring-Rear Bleed Manifold	.0910	.0935			
		Manifold-Bleed Rear (Seal Ring Prior To PN 770184)	.0945	.0965	.0010	.005	.007
		Seal Ring-Rear Bleed Manifold	.0900	.0940			
		Manifold-Bleed, Rear (Seal Ring PN 770184)	.0945	.0965	.0005	.0065	
	116	Head Gap Screw-Jack Screw Hole Filler			.000	.030	

REF. NO.	DESCRIPTION	REF. DIM. MIN	REF. DIM. MAX	LIMITS MIN	LIMITS MAX	REPLACE IF OVER
117	Head Gap Bolt-Diffuser Fan Duct Fairing Retainer			.005	.015	

(2) Torque Limits

REF. NO.	DESCRIPTION	LIMITS MIN	LIMITS MAX	REPLACE
1000	Nut - Retaining, No.1 Bearing Outer Race			
	1. Tighten nut to 2000 lb-in.			
	2. Mark location of nut with reference to mating part.			
	3. Turn nut through angle of 20 degrees min. to 27 degrees max.			
	4. Loosen nut to 0 lb-in. and repeat step 1.			
	5. If nut mark is in line with or beyond mating part reference mark within .100 inch max., apply final angle of turn per step 3.			
	6. If marks are not within limits, repeat steps 2., 3., and 4. in order, until marks are within limits. Then perform step 5.			
1001	Nut-Retaining, No. 1 Bearing Inner Race			
	1. Tighten nut to 2000 lb-in.			
	2. Establish common ref. points between the nut and its mating part.			
	3. Turn nut thru angle of 14 degrees			

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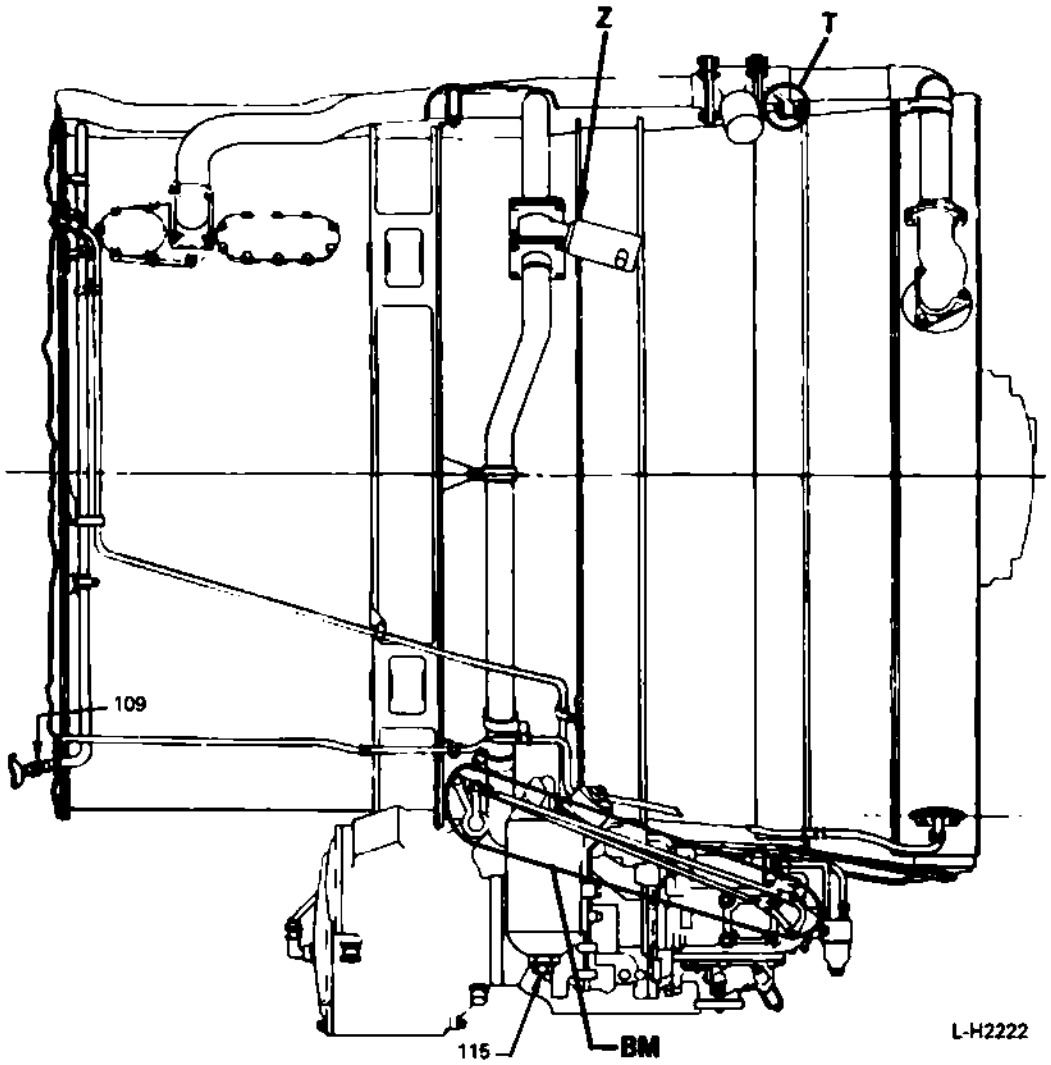
R

REF. NO.	DESCRIPTION	LIMITS MIN	MAX	REPLACE
(CONTINUED)	min. to 17 degrees max. 4. Loosen nut to 0 lb-in. and repeat step 1. 5. If the nut reference point is in line with the mating part ref. point or beyond it within 1°30' max, apply final angle of turn per step 3. 6. If the ref. points are not within limits, repeat steps 2, 3, and 4. in order, until ref. points are within limits. Then perform step 5.			
1008	Nuts-Retaining-Diffuser Case to Combustion Chamber Outer Case NOTE: Do not apply thread lubricant to this part.	65	75	
1017	Nut-Retaining, Immersion Thermocouple	450	500	
1018	Nut-Retaining, Immersion Thermocouple Lead (.190-32)	10	15	
1019	Nut-Retaining, Immersion Thermocouple Lead (164.32)	8	12	
1021	Igniter Plug	300	360	
1022	Nut-Coupling, No. 4 Bearing Scavenge Tube	130	140	
1023	Nut-Coupling, No. 4 Bearing Pressure Tube	110	120	
1024	Nut-Coupling, No. 4 Bearing Breather Manifold	200	220	
1031	Screw-Retaining, Exciter Bracket	15	20	

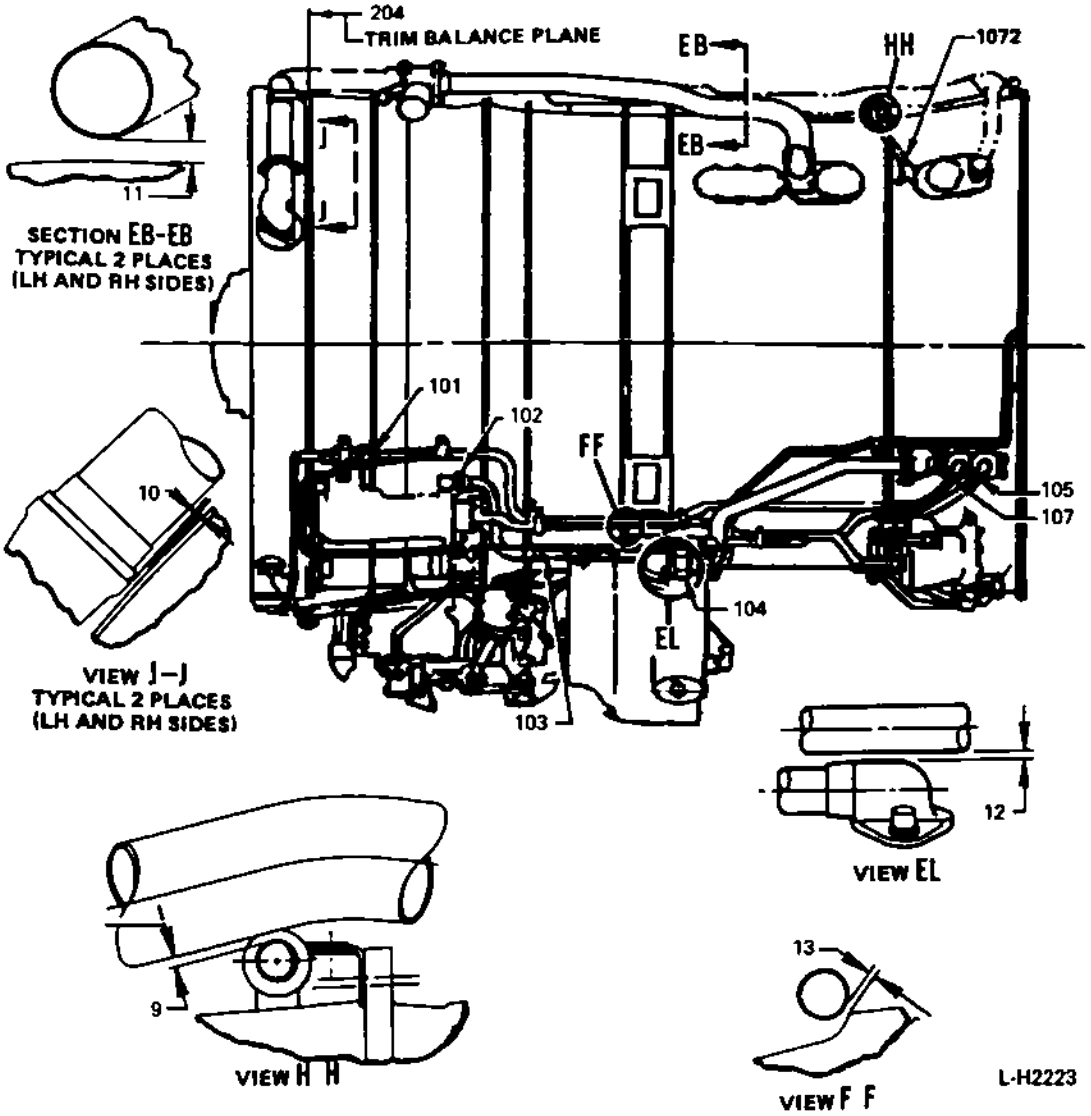
REF. NO.	DESCRIPTION	LIMITS MIN	MAX	REPLACE
1033	Bolt, PN 755167 Spacer To Front Case And Inlet Case	135	150	
1034	Bolt, Rear Case To Front Case And PN 351584 Spacer	110	120	
1035	No. 6 Bearing Outer Internal Tube Connector (Incorporating SB 5465)	135	150	
1036	Diffuser Pressure Sensing Tube Nut	10	20	

(3) Spring Loads

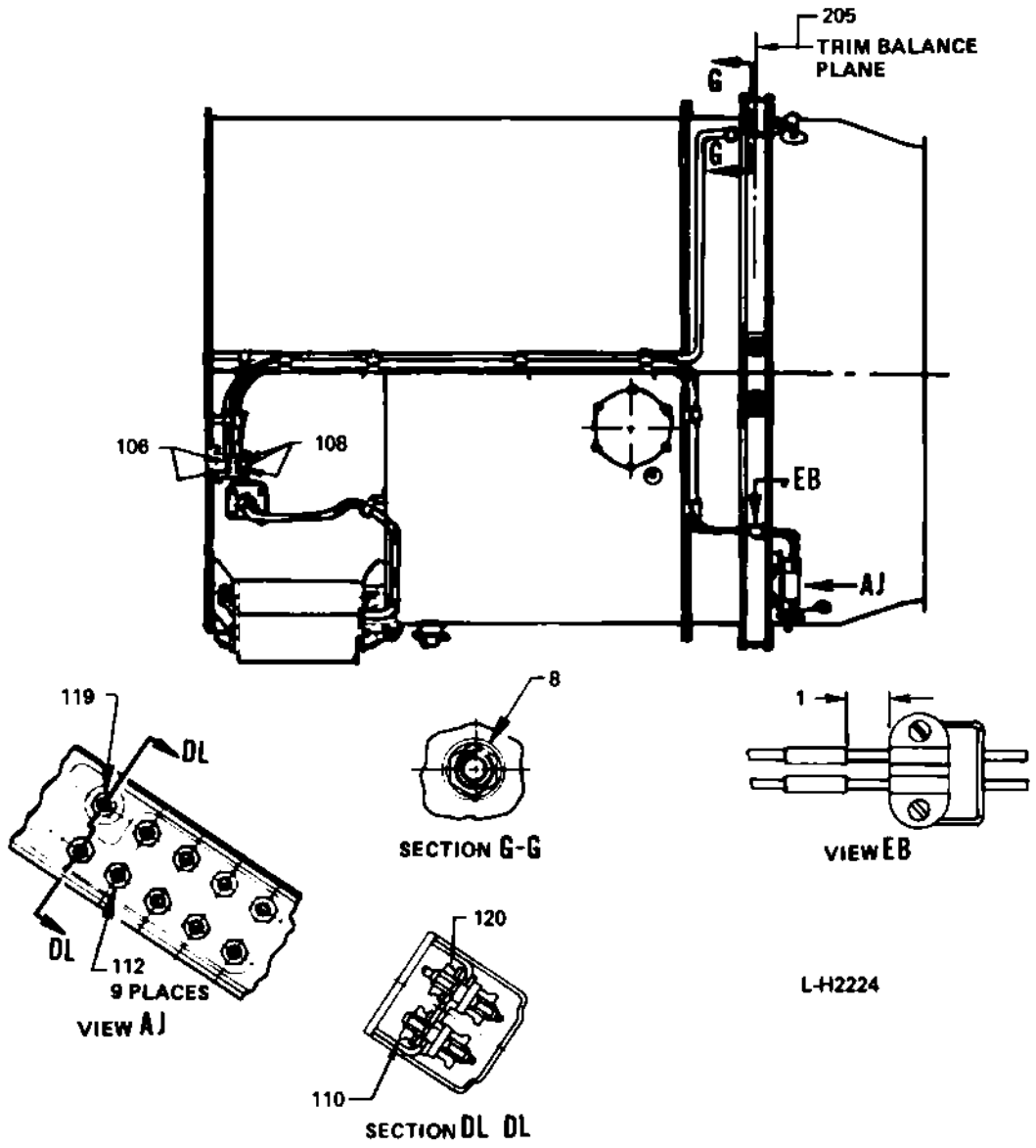
REF. NO.	DESCRIPTION	LIMITS MIN	MAX	REPLACE
1500	Spring-Bleed Manifold			
	at 1.678 in.	3.250	4.750	
	at 1.050	14.250	15.750	
2004	Nut-Retaining, Immersion Thermocouple Lead Assembly Instructions: Nuts must be assembled as shown.			



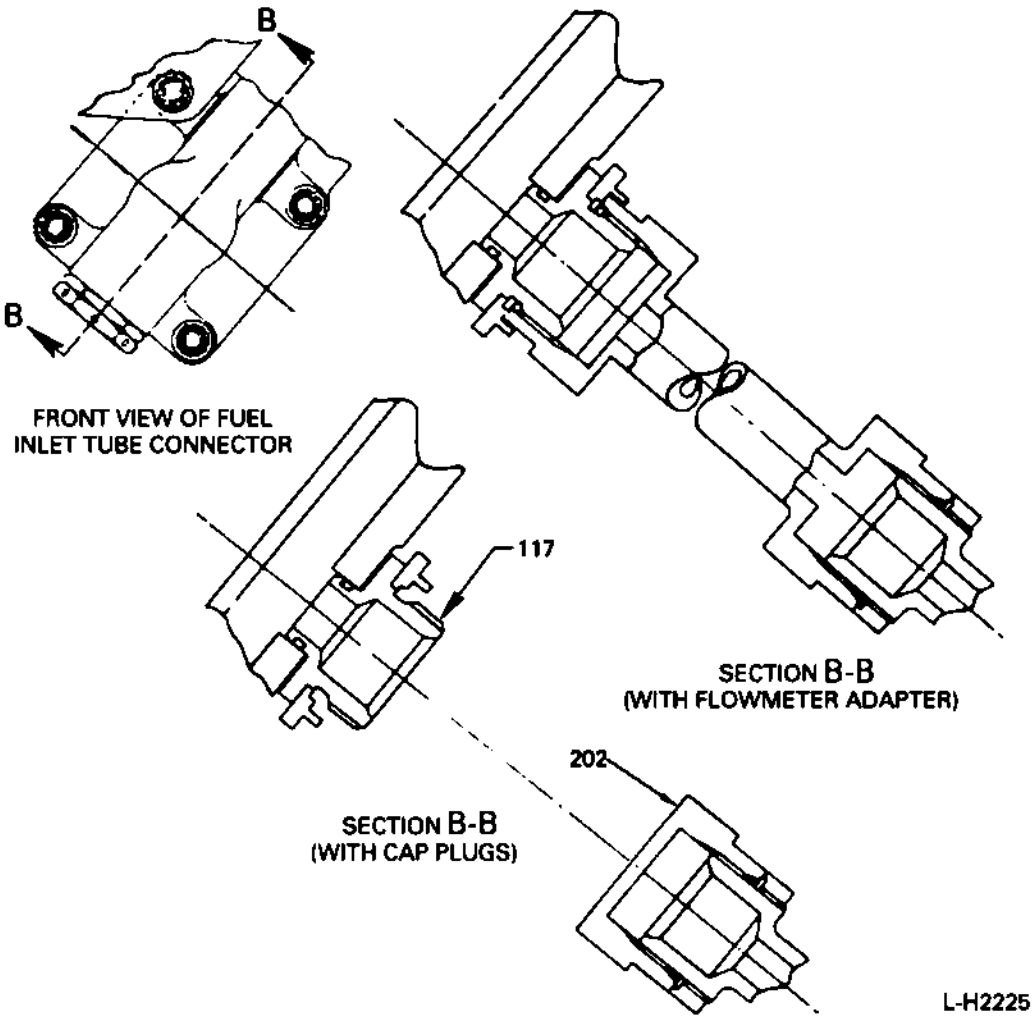
External Parts Clearance Chart
Figure 601 (Sheet 1)
(Task 72-00-00-220-001)



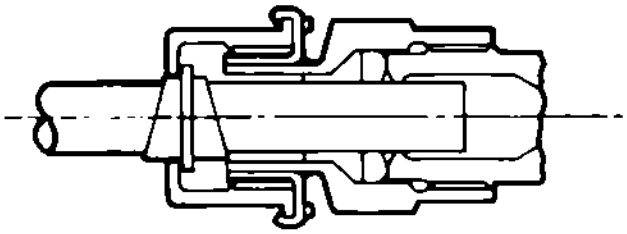
External Parts Clearance Chart
Figure 601 (Sheet 2)
(Task 72-00-00-220-001)



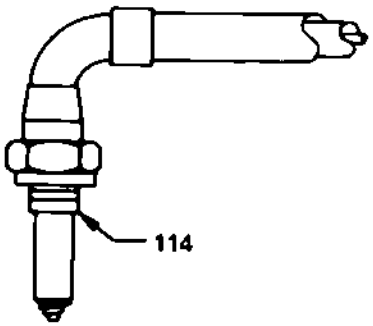
External Parts Clearance Chart
Figure 601 (Sheet 3)
(Task 72-00-00-220-001)



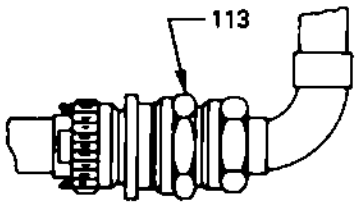
External Parts Clearance Chart
Figure 601 (Sheet 4)
(Task 72-00-00-220-001)



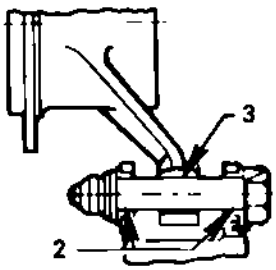
TYPICAL ASSEMBLY OF
NUT & TAB LOCK
ON TUBE ASSEMBLY
(SEE CHAPTER/SECTION 73)



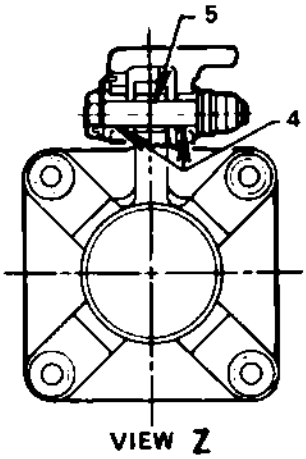
CIGARETTE TYPE
ELECTRICAL CONNECTIONS
(PLUG END)



ELECTRICAL CONNECTORS
AN 3100 THRU AN 3108

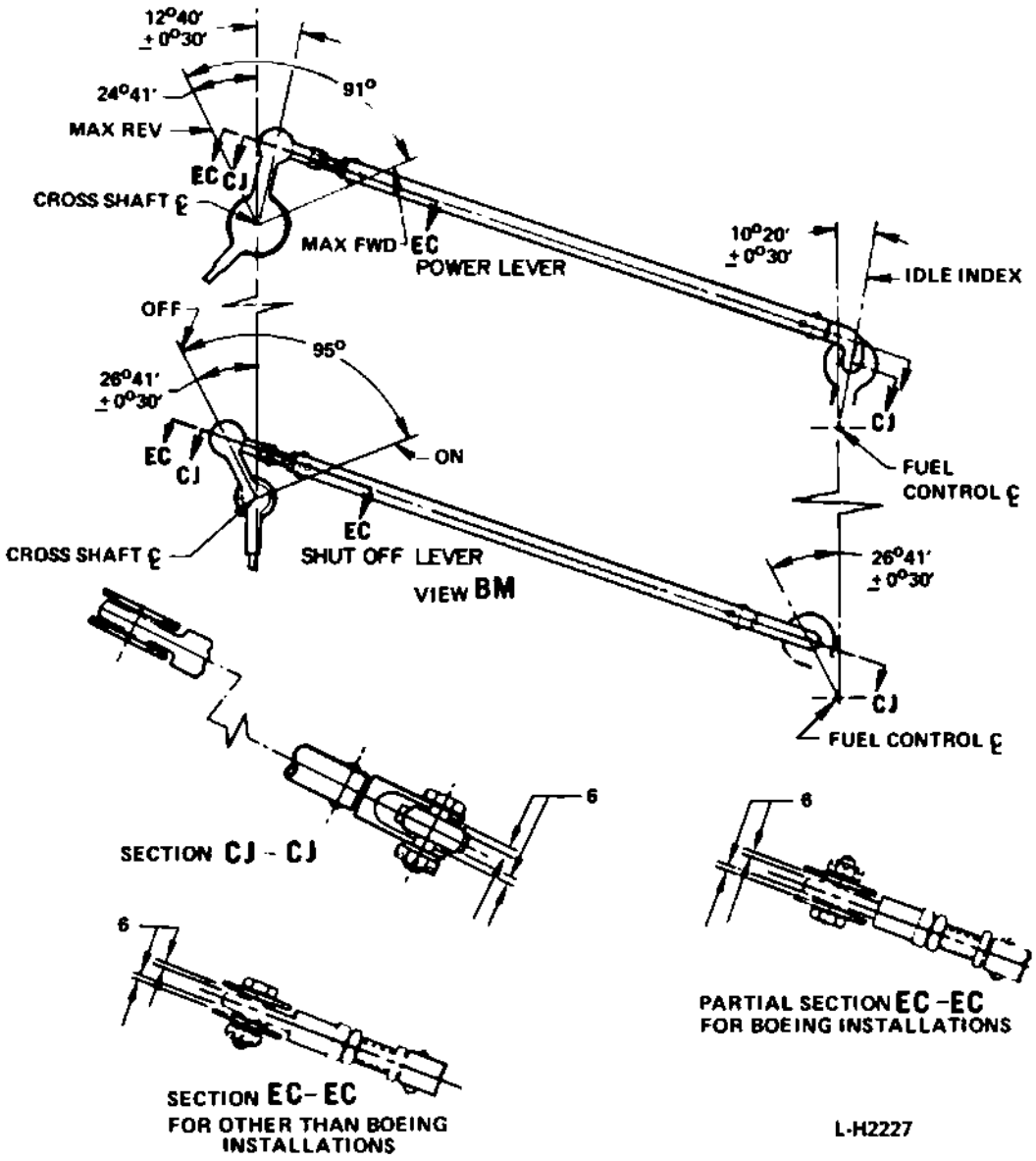


VIEW T
(TYPICAL BOTH SIDES
OF ENGINE)

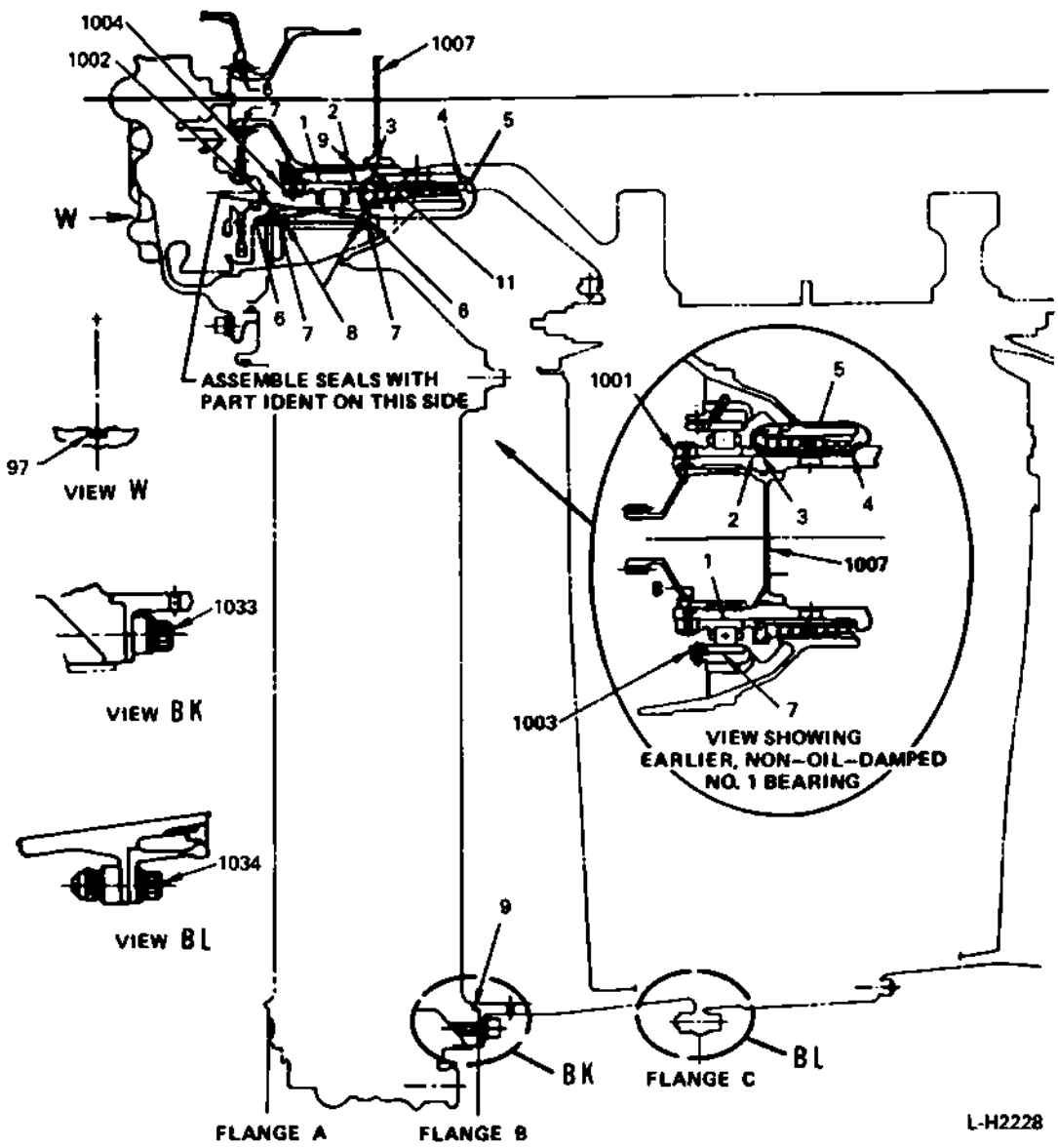


VIEW Z

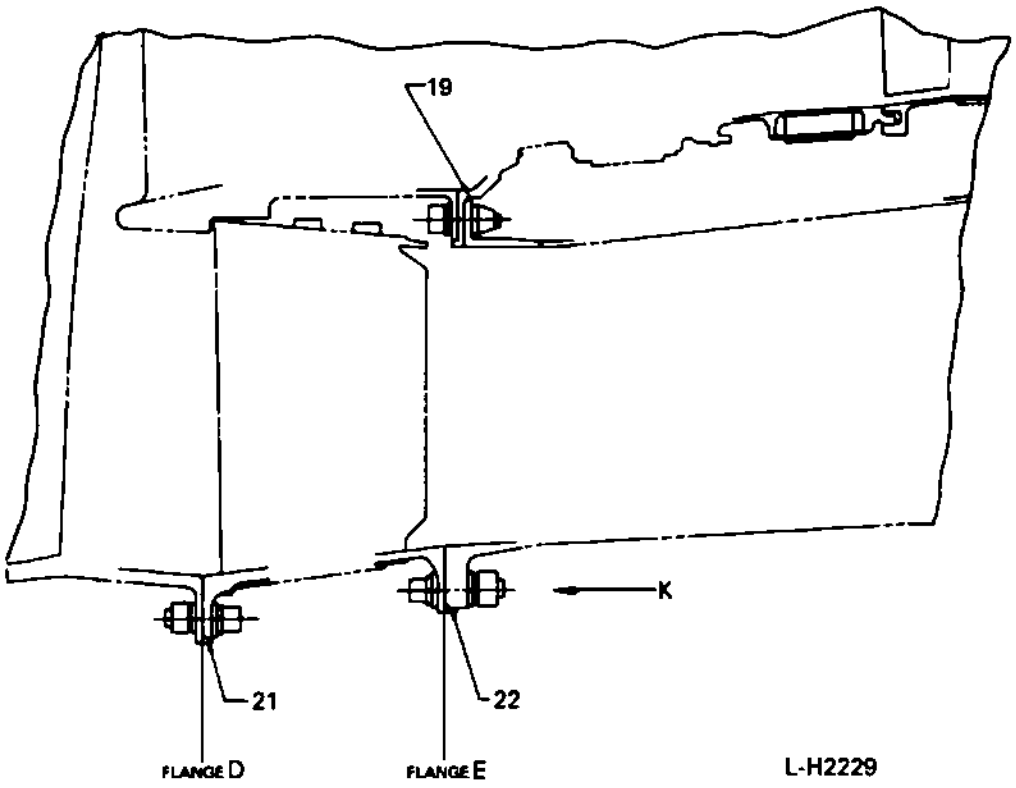
L-H2226



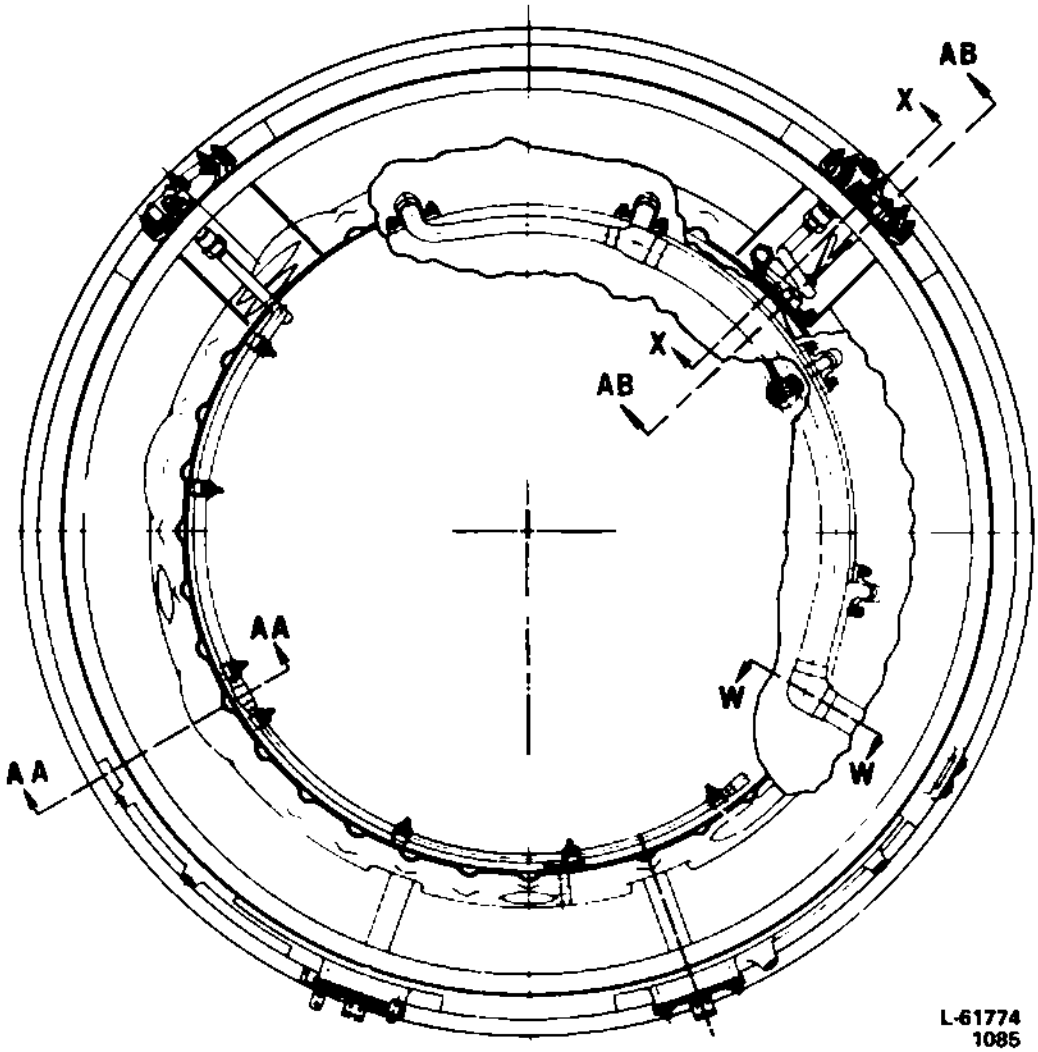
External Parts Clearance Chart
Figure 601 (Sheet 6)
(Task 72-00-00-220-001)



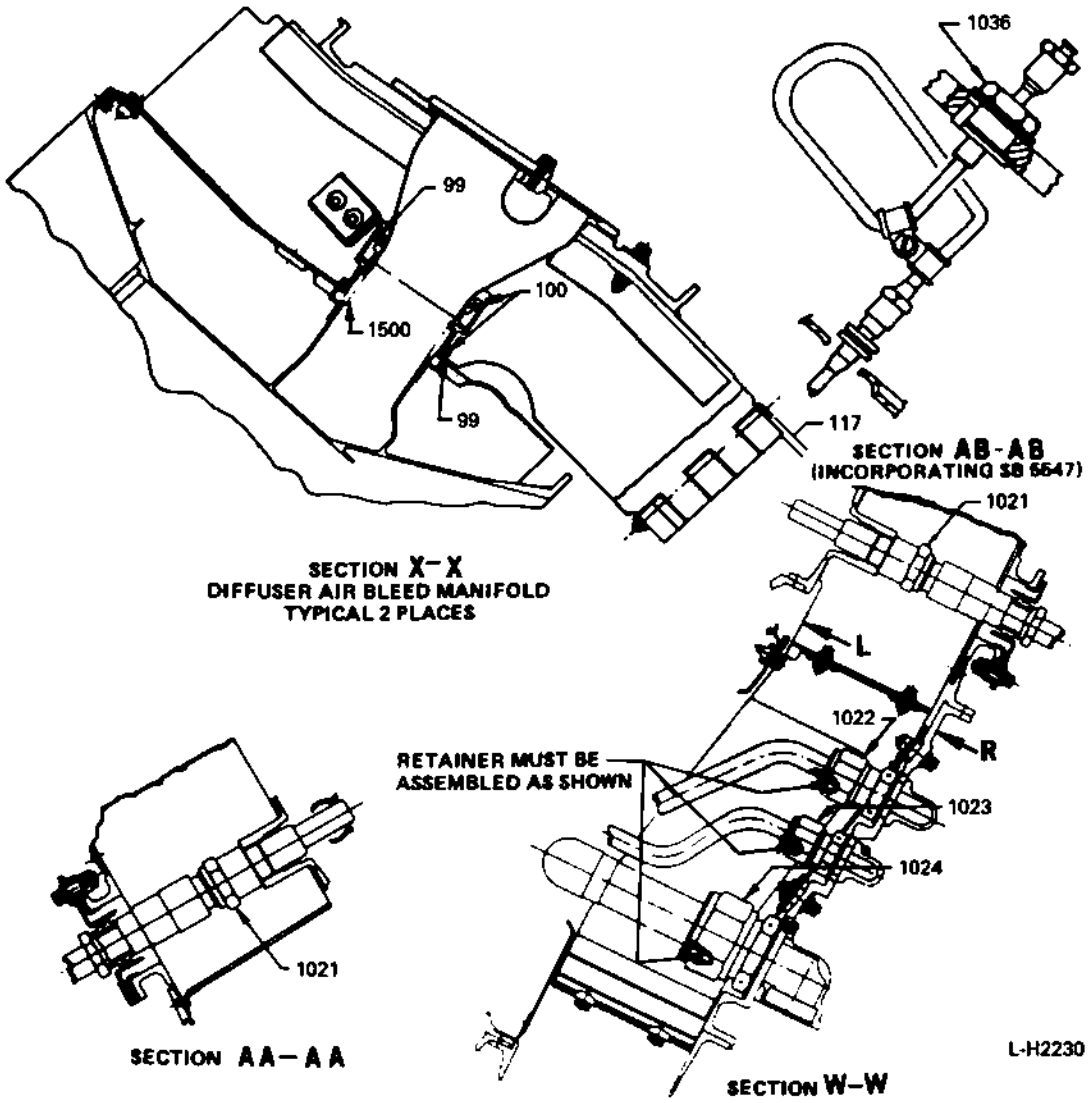
Engine Assembly Clearance Chart
Figure 602 (Sheet 1)
(Task 72-00-00-220-001)



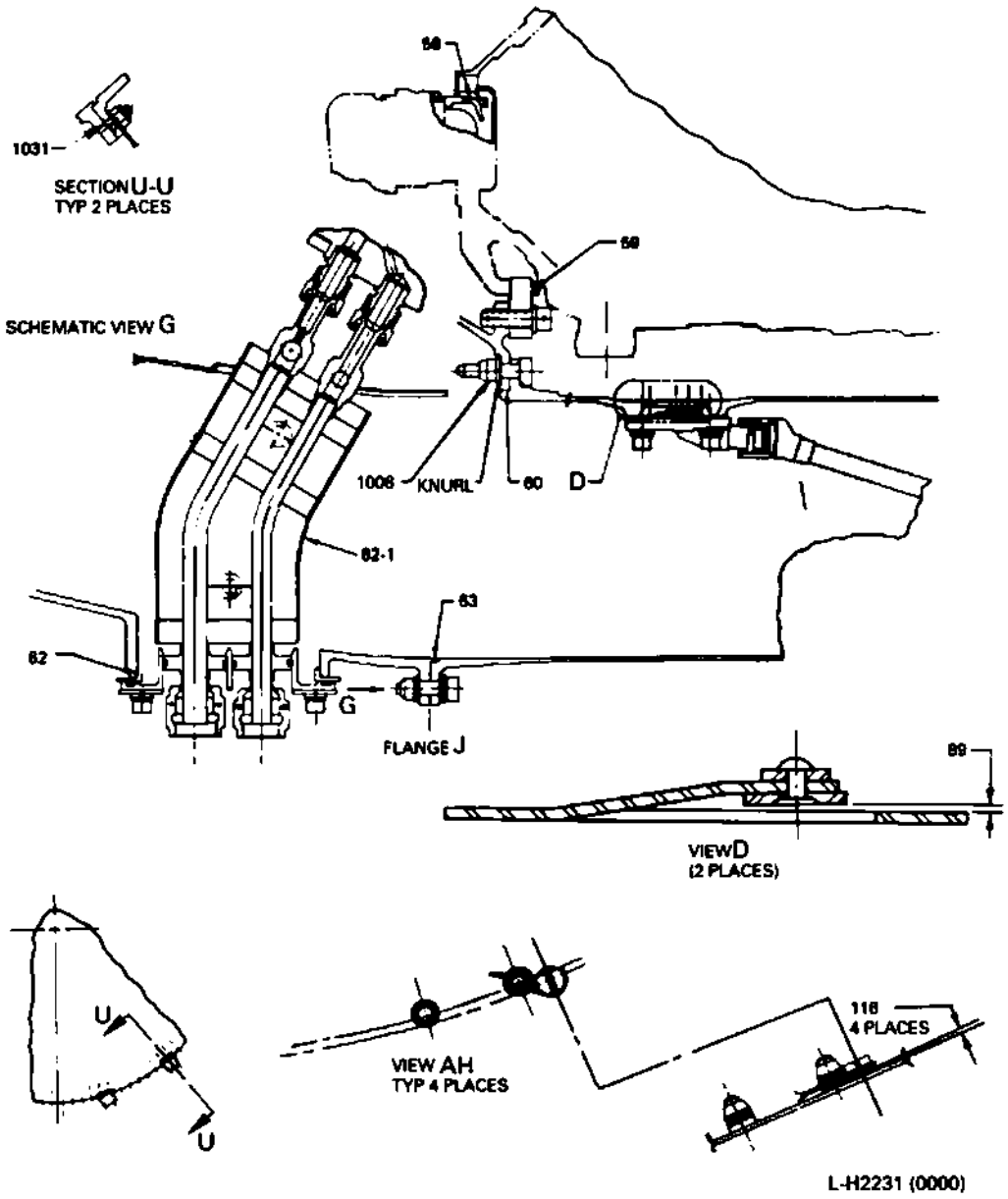
Engine Assembly Clearance Chart
Figure 602 (Sheet 2)
(Task 72-00-00-220-001)



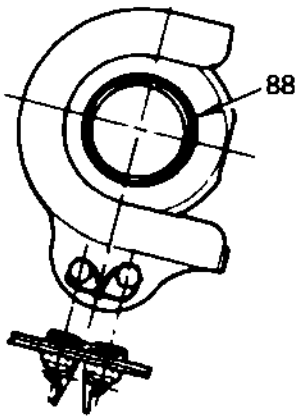
Engine Assembly Clearance Chart
Figure 602 (Sheet 3)
(Task 72-00-00-220-001)



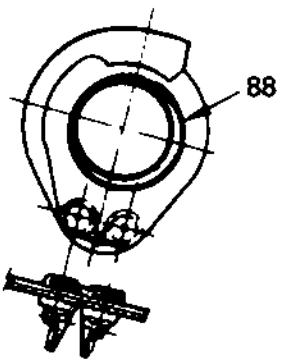
Engine Assembly Clearance Chart
Figure 602 (Sheet 4)
(Task 72-00-00-220-001)



Engine Assembly Clearance Chart
Figure 602 (Sheet 5)
(Task 72-00-00-220-001)

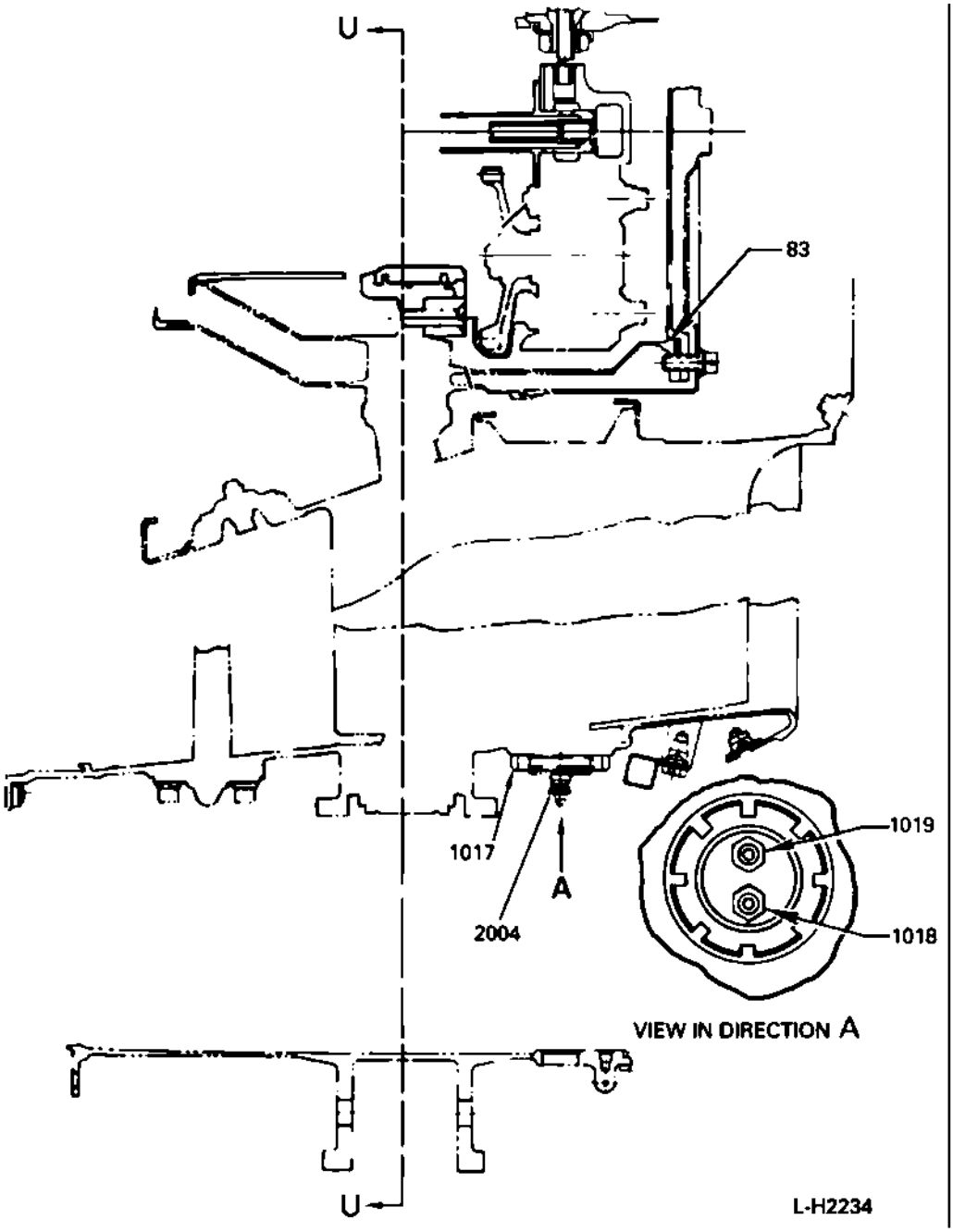


CROSS-SECTION THROUGH
COMBUSTION CHAMBER CROSSOVER TUBE
(FLOATING INTERCONNECTOR TUBE TYPE)

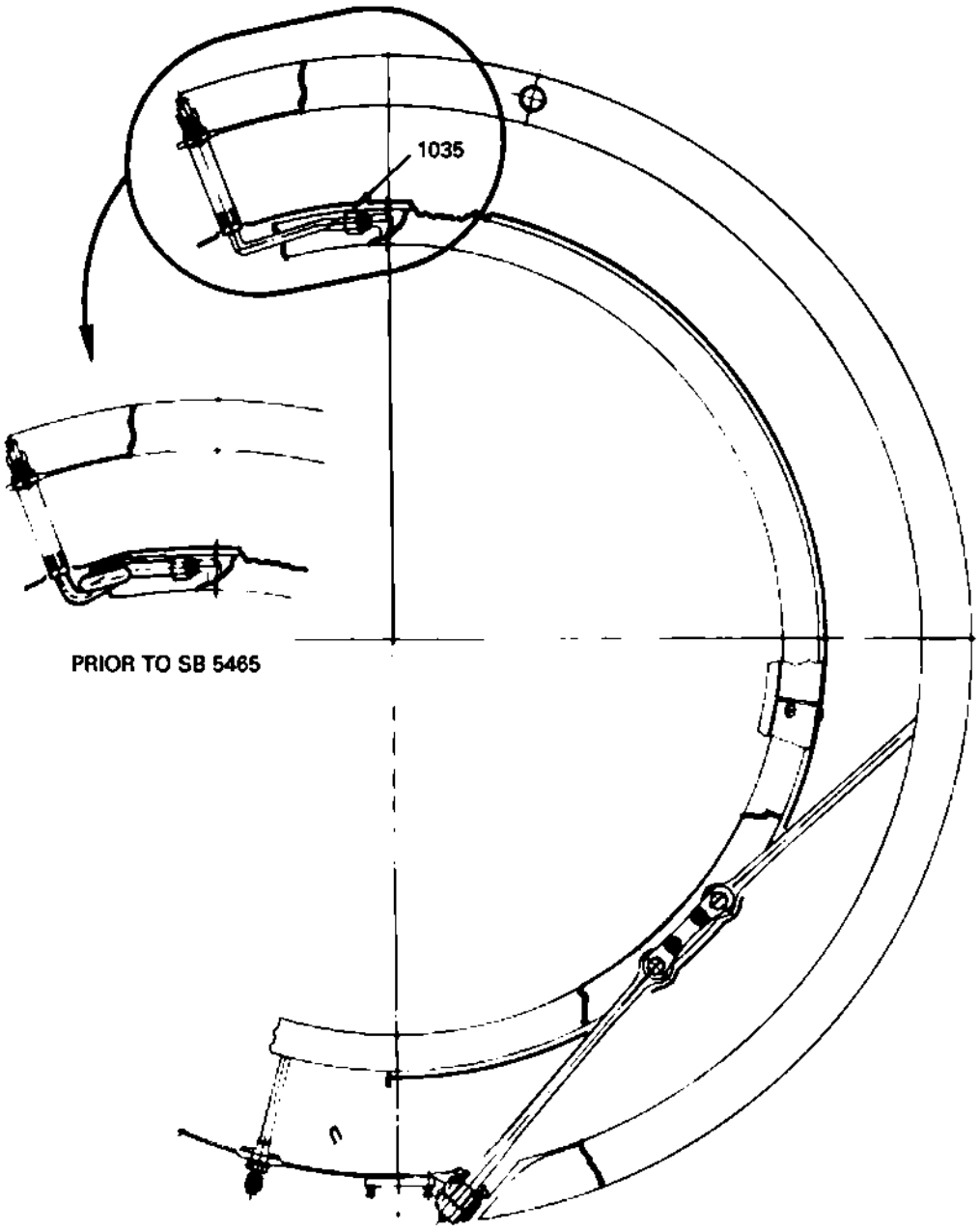


CROSS-SECTION THROUGH
COMBUSTION CHAMBER CROSSOVER TUBE
(BOLTED INTERCONNECTOR TUBE TYPE)

L-H2233



Engine Assembly Clearance Chart
Figure 602 (Sheet 7)
(Task 72-00-00-220-001)



Engine Assembly Clearance Chart
Figure 602 (Sheet 8)
(Task 72-00-00-220-001)

Task 72-00-00-110-001:

R 1. Carbon Face-Type Oil Seals

A. To maintain the efficiency of face-type oil seals, the following recommendations should be used as a guide in handling these seals.

R (1) Clean seals by SPOP 215 (refer to Chapter/Section
R 70-21-00 in the Standard Practices Manual, PN 585005).

(2) Each seal should be individually boxed, with a cardboard collar around the carbon portion of the seal.

(3) Do not remove the seals from their boxes until they are ready to be used.

(4) Seals once removed from their protective covering must not be handled so that there is any possibility of damage to their carbon faces. Seals should never be stacked.

R (5) Seals must not be exposed to foreign materials such as
R grit, dirt, or lint.

Task 72-00-00-110-002:

2. Clean Engine Gaspath For Performance Improvement

R CAUTION: REFER TO SPOP 425 (TASK 70-00-00-100-001) FOR ENGINES
R THAT HAVE HAD GASPATH EXPOSED TO FIRE EXTINGUISHING
R AGENTS, HYDRAULIC FLUID, OIL, OR FUEL.

NOTE: Engine performance deterioration, i.e. high power stalls, increase in low and high compressor speed, exhaust gas temperature, and thrust specific fuel consumption, may be due to contamination of blades and
R vanes of both compressors and turbines. Remove this
R contamination with fresh water or cleaning detergent
R solution (turn the engine rotors with the starter during
R this procedure). The following procedure is recommended on a regular basis. However, since environmental
R conditions vary widely, each operator should determine
R the interval of a periodic water wash program and when a
R detergent solution wash is necessary.

NOTE: This procedure can be used as necessary to decrease turbine sulfidation attack. If you use this procedure regularly, it can help to keep performance (EGT, TSFC) margins. This procedure must be done before you connect any test cell instrumentation or other electrical or mechanical leads except starter and N2 tachometer.

R A. Water Wash Procedure (Without Detergent)

R (1) Use this procedure to clean the engine gaspath for
R performance improvement. This procedure uses water to
R wash the engine and permits the option of using water
R or detergent. Refer to Paragraph B. for the detergent
R method.

R (2) Conduct pre-wash engine performance checks at EPRs of 1.4, data plate (1.65), and 1.8. At each point operate engine for five minutes, then record N1, N2, EGT, and fuel flow. For this check engine air bleed and electrical load extraction shall be zero.

R NOTE: This step is optional.

NOTE: Under icing conditions thermal anti-icing may be used between check points.

R (3) Shut down engine and allow at least 30 minutes for engine to cool.

R (4) Pull ignition circuit breaker for engine being washed.

R (5) Disconnect fuel control Pb sense line and Ps3, Pt2, and Ps4 lines to pressure ratio bleed control (it is not necessary to cap off fittings), and engine ignition leads. Disconnect Pt7 manifold lines.

R (6) If installed, disconnect the CSD pressurization line at
R the 6th stage bleed duct.

R (7) Disconnect generator cooling inlet (aft) supply duct.

R (8) If installed, disconnect the CSD pressurization line at
R the 6th stage bleed duct.

R (9) Ensure that start lever for engine being washed is in "off" position.

R (10) Ensure that all anti-icing air shutoff and fuel deicing heater shutoff valves (except engine bleed valves) are closed.

R (11) Do a check for correct silicone oil level in the fuel control burner pressure (Pb) bellows. Refer to Chapter/Section 73-21-01, Removal/Installation-00 (Task 73-21-01-450-001 or Chapter/Section 73-21-02, Removal/Installation-00 (Task 73-21-02-450-001).

R (12) Make certain N2 rotation is completely stopped, then engage starter and allow engine to reach full starting rpm. Do not exceed starter duty cycle.

WARNING: IN FOLLOWING WATER SPRAY PROCEDURE, IF HOSE IS HAND HELD, OPERATOR MUST STAND AT LEAST THREE FEET FROM ENGINE INLET.

R (13) Clean the engine gaspath by one of the methods that follow:

R (a) Use PWA 102995 Water Wash Nozzle.

R (b) Use PWA 33382 Spray Ring.

R (c) Use a 3/4-inch (19 mm) ID hose.

R NOTE: The hose method is the least effective method for cleaning the core engine gaspath because most of the water exits through the fan exhaust air ducts.

R (14) If you use the optional PWA 102995 Water Wash Nozzle, calibrate the nozzle or nozzles as follows. See Figure 704.

R NOTE: Two nozzles will provide better distribution in the core engine gaspath.

R (a) Extend the nozzle (or nozzles) to align the two scribe lines with the larger outside diameter ends of the nozzle and lock the nozzle in position.

R (b) Connect the hoses, adapters, PWA 83298 Distributor, and PWA 102995 Water Wash Nozzles to the water source.

R WARNING: BE SURE TO PUT A CAP ON THE DISTRIBUTOR
R HOSE THAT IS NOT ATTACHED TO A NOZZLE
R AND ATTACH IT TO A STRUCTURE. IF THE
R HOSE IS NOT SEALED WITH A CAP AND
R ATTACHED, IT CAN MAKE RANDOM MOVEMENTS
R AND CAUSE INJURY TO PERSONNEL AND/OR
R DAMAGE TO THE EQUIPMENT.

R (c) If you use only one nozzle, put a cap on one hose
R on the distributor and attach the hose to a
R structure.

R (d) Hold or attach the water wash nozzle (or nozzles)
R to a structure on the ground with clamps and start
R the water.

R (e) Adjust the distributor to get approximately 10 -
R 15 gallons (38 - 57 liters) for each minute total
R flow at 50 - 100 psi (344.7 - 689.5 kPa) for two
R nozzles which is 5 - 7 1/2 gallons (19 - 28
R liters) for each nozzle (or one nozzle).

R NOTE: You can calculate the flow rate with
R a container of a known volume and a stop
R watch.

R (f) Make a mark on the distributor and valve handle
R for the correct position.

R (g) Turn off the water source.

R (h) Remove the nozzle (or nozzles) from the
R distributor.

R (15) If you use the optional PWA 102995 Water Wash Nozzle,
R install the water wash nozzle (or nozzles) as follows.
R See Figure 705.

R (a) Make sure that the N1 and N2 rotation are fully
R stopped.

R (b) You can use one or two nozzles. If you use one
R nozzle, install it at the 12 o'clock position. If
R you use two nozzles, install one at the 3 o'clock
R position and one at the 9 o'clock position.

R (c) Use two persons and carefully install the nozzle
R (or nozzles) inside the tailpipe and move it
R forward between two fan exit guide vanes. Push
R the spring loaded stop against the fan exit guide
R vanes. Adjust the spray tip between the fan
R blades until the spray tip can be pulled back to
R hook it on the front of the 2nd stage stator outer
R shroud.

R 1 If necessary, adjust the length of the water
R wash nozzle.

R (d) Make sure that the water flow will go in the
R engine core gaspath.

R (e) Adjust the nozzle clamp and attach it to the rear
R of the tailpipe with the swivel head screw.

R (f) Attach the distributor to the nozzle (or nozzles).

R WARNING: BE SURE TO PUT A CAP ON THE
R DISTRIBUTOR HOSE THAT IS NOT ATTACHED
R TO A NOZZLE AND ATTACH IT TO A
R STRUCTURE. IF THE HOSE IS NOT SEALED
R WITH A CAP AND ATTACHED, IT CAN MAKE
R RANDOM MOVEMENTS AND CAUSE INJURY
R TO PERSONNEL AND/OR DAMAGE TO THE
R EQUIPMENT.

R 1 If you use only one nozzle, put a cap on one
R hose on the distributor and attach the hose to
R a structure.

R (g) Attach the distributor and hoses so that they do
R not move while you motor the engine.

R (h) Examine the equipment installation as follows.

R 1 If necessary, change the position of the
R nozzle.

R 2 Look from the front to make sure that there
R is sufficient clearance between the 2nd stage
R fan blades and the nozzle spray tip to prevent
R possible part damage during the procedure.

R **CAUTION: MAKE SURE THAT THE MARKS ON THE**
R **DISTRIBUTOR AND VALVE HANDLE ARE**
R **ALIGNED. THE MARKS WERE MADE WHEN THE**
R **NOZZLE(S) WERE CALIBRATED. IF THE**
R **MARKS ARE NOT ALIGNED, THE WATER FLOW**
R **VOLUME WILL NOT BE CORRECT.**

R 3 Make sure that the marks on the distributor and
R valve handle are aligned.

R 4 Make sure that you can turn the LPC freely by
R hand before you use the air starter.

R (16) For outside ambient temperatures less than 40°F (4.4°C),
R mix Isopropyl Alcohol (P11-014) to the water as shown
R in Table 701. However, a mixture of 50 percent alcohol
R may be used.

R NOTE: At 40°F (4.4°C) and below, be careful during
R the water wash that there is no ice which could
R cause damage to the engine.

R (17) If the hose method is used, the spray should be
R directed to the center of the engine but not directly
R at the nose cone. Approximately 40 - 50 gallons
R (151.42 - 189.27 liters) of water can flow during a 30
R second interval.

R **WARNING: KEEP THE NOZZLE AWAY FROM THE FAN BLADES AS**
R **THEY TURN (INJURY TO PERSONNEL AND/OR DAMAGE**
R **TO FAN BLADES CAN BE THE RESULT).**

R WARNING: IF HOSE IS HAND HELD, OPERATOR MUST STAND AT
R LEAST THREE FEET FROM ENGINE INLET.

R (18) Use the starter to motor the engine at approximately
R 2500 RPM N2.

R (19) While you motor the engine, start the water and flow
R it into the engine for approximately 30 - 45 seconds.
R Stop the motoring cycle. Do this cycle three (3) times
R with five minutes with the engine stopped between each
R cycle.

R NOTE: If water flow from the tail pipe is dirty,
R additional benefit may be gained by additional
R wash. The operator may elect to repeat the wash
R procedure at their discretion.

Percent Alcohol By Volume	Outside Air Temperature
3	40°F (4.4°C)
6	38°F (3.3°C)
9	36°F (2.2°C)
14	33°F (0.6°C)
17	31°F (-0.6°C)
20	28°F (-2.2°C)
22	26°F (-3.3°C)
23	25°F (-3.9°C)
27	20°F (-6.6°C)
32	15°F (-9.4°C)
36	10°F (-12.2°C)
39	5°F (-15°C)
43	0°F (-17.8°C)

Minimum Required PMC 9094
Isopropyl Alcohol To Water Mixture
Table 701

R (20) Remove the water wash ring assembly, nozzle or nozzles (if used). Examine the inlet guide vanes to be sure that they are not damaged.

R (21) Clean the 1st stage (fan) blades by one of these methods:

R (a) Wipe the blades with SPMC 148 Wipe Cleaner and a clean cloth. A Tampico or nylon brush may be used to scrub fan blades. Wipe off with a clean cloth. Rinse is not necessary.

R (b) Or, use a solution of SPS 87 Gaspath Cleaner. Apply with a clean cloth, Tampico or nylon brush. Rinse blades thoroughly with potable water. See Refer to Chapter/Section 70-00-00, Cleaning/Painting-11 (Task 70-00-00-100-011), Standard Practices, for SPS 87 make-up.

R (c) Motor the engine with the starter for 30 seconds to remove water.

R (22) Blow water out of all lines with clean shop air or nitrogen before you reconnect them.

R (23) Reconnect fuel control Pb sense line and Ps3, Pt2 and Ps4 lines to pressure ratio bleed control and engine ignition leads. Reconnect Pt7 manifold lines.

R (24) Connect general cooling inlet (aft) supply duct and reset ignition system circuit breaker for washed engine. Remove plug from fuel control Pb tube moisture trap and check for entrapped water.

R (25) Reconnect engine and airframe and electrical circuits,
R and reinstall ducts and panels.

R (26) Conduct post-wash engine performance check at EPRs of 1.4, data plate (1.65) and 1.8. At each point operate engine for five minutes, then record N1, N2, EGT, and fuel flow. For this check engine air bleed and electrical load extraction will be zero. This step should be done immediately after washing engine.

R NOTE: This step is optional.

NOTE: Observe N1 rpm for indication of low compressor rotation while rotating engine with starter and prior to opening fuel shutoff lever.

CAUTION: IN FOLLOWING STEP DO NOT EXCEED GROUND STATIC EGT OPERATIONAL LIMITS WHEN USING ANTI-ICING AIR SYSTEM.

R (27) If engine is to stay inoperative for four hours or more
R after wash, start the engine and run at Idle for five
R minutes. Operate the anti-icing air shutoff, fuel heat
R and air conditioning system valves. Operate the air
R conditioning system in full-cold mode to push undrained
R water through the water separator.

R NOTE: Under very cold and windy weather conditions,
R even if water/alcohol mixture is used, it is
R very possible that there will be ice in the
R engine in less than four hours if engine run-up
R is not done after wash, to remove or evaporate
R remaining water.

R NOTE: Before the fuel shutoff lever is opened, monitor
R N1 rpm for indication of low compressor rotation
R while the engine is motored with the starter.

R (28) Do an engine shutdown and a water check of the fuel
R control Pb tube moisture trap. Also do a water check
R of the fuel control bellows cavity.

R NOTE: Entrapped water in the pb bellows cavity can
R prevent correct engine operation.

R B. Clean Engine Gaspath Wash (With Detergent) For Performance
R Improvement

R CAUTION: REFER TO SPOP 425 (TASK 70-00-00-100-001) FOR
R ENGINES THAT HAVE HAD GASPATH EXPOSED TO FIRE
R EXTINGUISHING AGENTS, HYDRAULIC FLUID, OIL,
R OR FUEL.

R (1) Do pre-wash engine performance checks at EPRs of 1.4,
R data plate (1.65), and 1.8. At each point operate the
R engine for five minutes, then record N1, N2, EGT,
R and fuel flow. For this check engine air bleed and
R electrical load extraction must be zero.

R NOTE: This step is optional.

R NOTE: Under icing conditions thermal anti-icing may be
R used between check points.

R (2) Do an engine shutdown and let the engine become cool
R for 30 minutes or more.

R (3) Pull the ignition circuit breaker for the engine that
R gets the wash procedure.

R (4) Disconnect the fuel control Pb sense line and Ps3, Pt2,
R and Ps4 lines to the pressure ratio bleed control (it
R is not necessary to put caps on the fittings), and
R engine ignition leads. Disconnect Pt7 manifold lines.

R (5) If installed, disconnect the CSD pressurization line at
R the 6th stage bleed duct.

R (6) Disconnect the generator cooling inlet (aft) supply
R duct.

R (7) Disconnect the thrust reverser and hydraulic reservoir
R pressurization line at the engine.

R (8) Make sure that the start lever for engine that is
R washed is in the "off" position.

R (9) Make sure that all anti-icing air shutoff and fuel
R deicing heater shutoff valves (except engine bleed
R valves) are closed.

R (10) Do a check for correct silicone oil level in the
R fuel control burner pressure (Pb) bellows. Refer to
R Chapter/Section 73-21-01, Removal/Installation-00
R (Task 73-21-01-450-001) or Chapter/Section 73-21-02,
R Removal/Installation-00 (Task 73-21-02-450-001).

R (11) Pressurize the breather compartment with external air
R at 10 psig (68.9 kPa) at one of these locations:

R (a) No. 4 and 5 bearing breather boss (also put caps
R on the breather fittings on the gearbox).

R (b) Overboard breather fitting on the gearbox.

R (12) Make sure N2 rotation is fully stopped, then engage the
R starter and let the engine get to full start rpm. Do
R not exceed the starter duty cycle.

R (13) Prepare 20 gallons of gaspath cleaner solution. Refer
R to Chapter/Section 70-00-00, Cleaning/Painting-11 (Task
R 70-00-00-100-011), Standard Practices, for SPS 87
R Gaspath Cleaner Solution with potable water.

R NOTE: Mix the solution fully and start the water wash
R one hour or less after the solution is mixed.

R (14) For outside ambient temperatures less than 40°F (4.4°C),
R mix Isopropyl Alcohol (P11-014) with the water as shown
R in Table 701. However, a mixture of 50 percent alcohol
R is permitted.

R NOTE: At 40°F (4.4°C) and below, be careful during the
R water wash that there is no ice which can cause
R damage to the engine.

R (15) If you use the PWA 102995 Water Wash Nozzle, calibrate
R the nozzle or nozzles as follows. See Figure 704.

R NOTE: Two nozzles will provide better distribution in
R the core engine gaspath.

R (a) Extend the nozzle (or nozzles) to align the two
R scribe lines with the larger outside diameter ends
R of the nozzle and lock the nozzle in position.

R (b) Connect the hoses, adapters, PWA 83298
R Distributor, and PWA 102995 Water Wash Nozzles to
R the water source.

R WARNING: BE SURE TO PUT A CAP ON THE DISTRIBUTOR
R HOSE THAT IS NOT ATTACHED TO A NOZZLE
R AND ATTACH IT TO A STRUCTURE. IF THE
R HOSE IS NOT SEALED WITH A CAP AND
R ATTACHED, IT CAN MAKE RANDOM MOVEMENTS
R AND CAUSE INJURY TO PERSONNEL AND/OR
R DAMAGE TO THE EQUIPMENT.

R (c) If you use only one nozzle, put a cap on one hose
R on the distributor and attach the hose to a
R structure.

R (d) Hold or the water wash nozzle (or nozzles) or
R attach them to a structure on the ground with
R clamps and start the water.

R (e) Adjust the distributor to get approximately 10 -
R 15 gallons (38 - 57 liters) for each minute total
R flow at 50 - 100 psi (344.7 - 689.5 kPa) for two
R nozzles which is 5 - 7.5 gallons (19 - 28 liters)
R for each nozzle (or one nozzle).

R NOTE: You can calculate the flow rate with
R a container of a known volume and a stop
R watch.

R (f) Make a mark on the distributor and valve handle
R for the correct position.

R (g) Stop the water source.

R (h) Remove the nozzle (or nozzles) from the
R distributor.

R (16) If you use the optional PWA 102995 Water Wash Nozzle,
R install the water wash nozzle (or nozzles) as follows.
R See Figure 705.

R (a) Make sure that the N1 and N2 rotation are fully
R stopped.

R (b) You can use one or two nozzles. If you use one
R nozzle, install it at the 12 o'clock position. If
R you use two nozzles, install one at the 3 o'clock
R position and one at the 9 o'clock position.

R (c) Use two persons and carefully install the nozzle
R (or nozzles) inside the tailpipe and move it
R forward between two fan exit guide vanes. Push
R the spring loaded stop against the fan exit guide
R vanes. Adjust the spray tip between the fan
R blades until it is possible to pull back the spray
R tip to catch it on the front of the 2nd stage
R stator outer shroud.

R 1 If necessary, adjust the length of the water
R wash nozzle.

R (d) Make sure that the water flow will go in the
R engine core gaspath.

R (e) Adjust the nozzle clamp and attach it to the rear
R of the tailpipe with the swivel head screw.

R (f) Attach the distributor to the nozzle (or nozzles).

R WARNING: BE SURE TO PUT A CAP ON THE
R DISTRIBUTOR HOSE THAT IS NOT ATTACHED
R TO A NOZZLE AND ATTACH IT TO A
R STRUCTURE. IF THE HOSE IS NOT SEALED
R WITH A CAP AND ATTACHED, IT CAN MAKE
R RANDOM MOVEMENTS AND CAUSE INJURY
R TO PERSONNEL AND/OR DAMAGE TO THE
R EQUIPMENT.

R 1 If you use only one nozzle, put a cap on one
R hose on the distributor and attach the hose to
R a structure.

R (g) Attach the distributor and hoses so that they do
R not move while the engine os motored.

R (h) Do a check of the equipment installations.

R 1 Move the position of the nozzle if necessary.

R 2 Look from the front to make sure that there is
R sufficient clearance between the 2nd stage fan
R blades and the nozzle spray tip (to prevent
R part damage during the procedure).

R CAUTION: MAKE SURE THAT THE MARKS ON THE
R DISTRIBUTOR AND VALVE HANDLE ARE
R ALIGNED. THE MARKS WERE MADE WHEN THE
R NOZZLE(S) WERE CALIBRATED. IF THE
R MARKS ARE NOT ALIGNED, THE WATER FLOW
R VOLUME WILL NOT BE CORRECT.

R 3 Make sure that the marks on the distributor and
R valve handle are aligned.

R 4 Make sure that you can turn the front
R compressor freely by hand before you engage the
R air starter.

R (17) Motor the engine with the starter at approximately 2500
R rpm N2.

R (18) Motor the engine and start the water. Flow water
R into the engine for approximately 30 - 45 seconds.
R Disengage the starter. Five minutes after the engine
R is stopped do the cycle again, three times (with the
R five-minute interval between cycles).

R (19) If you used detergent cleaning solution, do the wash
R procedure two (2) more times with water only.

R NOTE: This is necessary to rinse all detergent from
R the gaspath.

R (20) Remove the water wash ring assembly, nozzle or nozzles
R (if used). Inspect inlet guide vanes to make sure that
R they are not damaged.

R (21) Clean the 1st stage (fan) blades by one of these
R methods:

R (a) Wipe the blades with SPMC 148 Wipe Cleaner and a
R clean cloth. A Tampico or nylon brush may be used
R to scrub fan blades. Wipe off with a clean cloth.
R Rinse is not necessary.

R (b) Or, use a solution of SPS 87 Gaspath Cleaner.
R Apply with a clean cloth, Tampico or nylon brush.
R Rinse blades thoroughly with potable water. Refer
R to Chapter/Section 70-00-00, Cleaning/Painting-11,
R (Task 70-00-00-100-011) in Standard Practices, for
R SPS 87 make-up.

R (c) Motor the engine with the starter for 30 seconds
R to remove water.

R (22) Remove water from all lines with clean shop air or
R nitrogen before you reconnect them.

R (23) Reconnect the fuel control Pb sense line and Ps3, Pt2
R and Ps4 lines to the pressure ratio bleed control and
R the engine ignition leads. Reconnect the Pt7 manifold
R lines.

R (24) Connect the general cooling inlet (aft) supply duct
R and reset the ignition system circuit breaker for the
R washed engine.

(25) Reconnect engine and airframe and electrical circuits, and reinstall ducts and panels.

(26) Drain and fill the oil system again with new oil.

R (27) Remove the plug from the fuel control Pb tube moisture
R trap and look for water in the trap.

R (28) Conduct post-wash engine performance check at EPRs of
R 1.4, data plate (1.65) and 1.8. At each point operate
R the engine for five minutes, then record N1, N2, EGT,
R and fuel flow. For this check engine air bleed and
R electrical load extraction must be zero. Do this step
R immediately after the engine is washed.

R NOTE: This step is optional.

R NOTE: Before you open the fuel shutoff lever, make
R sure that there is rotation of the front
R compressor while the engine is motored by the
R starter.

R CAUTION: IN THE STEP THAT FOLLOWS DO NOT EXCEED
R GROUND STATIC EGT OPERATIONAL LIMITS DURING
R ANTI-ICING AIR SYSTEM OPERATION.

R (29) If engine is to stay inoperative for four hours or more
R after wash, start the engine and run at Idle for five
R minutes. Operate the anti-icing air shutoff, fuel heat
R and air conditioning system valves. Operate the air

R conditioning system in full-cold mode to push undrained
R water through the water separator.

R NOTE: Under very cold and windy weather conditions,
R even if water/alcohol mixture is used, it is
R very possible that there will be ice in the
R engine in less than four hours if engine run-up
R is not done after wash, to remove or evaporate
R remaining water.

R NOTE: Before you open the fuel shutoff lever, make
R sure that there is rotation of the front
R compressor while the engine is motored by the
R starter.

R (30) Do an engine shutdown and a water check of the fuel
R control Pb tube moisture trap. Also do a water check
R of the fuel control pb bellows cavity

R NOTE: Entrapped water in the pb bellows cavity can
R prevent correct engine operation.

C. Turbine Wash Procedure (Optional)
See Figure 701.

NOTE: The following procedure may be utilized using either one or two water wash probes, as required, to retard turbine blade airfoil sulfidation. Regular, frequent use of this procedure will also aid in maintaining performance margins (EGT, TSFC). This procedure is effective only on rotating turbine blade airfoils, and not on stationary turbine vanes, regardless of whether one or two probes are used.

(1) Allow at least 30 minutes for engine to cool after shutdown.

(2) Pull ignition circuit breaker for engine being washed.

(3) Ensure that start lever for engine being washed is in "off" position.

(4) Ensure that all anti-icing air shutoff and fuel deicing heater shutoff valves (except engine bleed valves) are closed.

R (5) Do a check for correct silicone oil level in the
R fuel control burner pressure (Pb) bellows. Refer to
R Chapter/Section 73-21-01, Removal/Installation-00
R (Task 73-21-01-450-001) or Chapter/Section 73-21-02,
R Removal/Installation-00 (Task 73-21-02-450-001).

(6) Disconnect both igniter plug leads and remove packing holders from igniter plug bosses. Unscrew and remove igniter plugs.

(7) Insert PWA 33594 Water Wash Probe in each igniter probe boss and extend each probe into No. 4 or 7 combustion chamber as follows:

NOTE: Either one or two water wash probes may be used. When only one probe is used it may be installed in either the No. 4 or 7 combustion chamber.

(a) Slide rubber stopper toward connector end of probe to allow full insertion of probe into combustion section.

(b) Insert probe into right or left side fan duct igniter plug boss, through combustion chamber outer case boss, and into combustion chamber (No. 4 or 7 chamber, as applicable).

(c) Move probe inward carefully, until tip of probe is felt to contact inner surface of combustion chamber. Withdraw probe approximately one-quarter inch so that probe tip does not contact combustion chamber wall (see figure).

(d) Slide rubber stopper down tube of probe until stopper can be firmly inserted in igniter plug boss at fan duct. Ensure that probe is still correctly positioned, with black mark on outer end of probe tube facing rearward.

NOTE: Once stopper is correctly positioned, probe can be used on left or right side of any JT8D engine without further adjustment, but it is recommended that position of probe be frequently checked as directed.

(e) Insert second probe in igniter plug boss on other side of engine and adjust position in same manner as for first probe.

(f) Connect water hose to each of probe hose connections and connect hose to source of clean, drinking-quality water capable of at least 40 psi pressure.

NOTE: See Chapter/Section 70-00-00, Cleaning/ Painting-10 (Task 70-00-00-990-010), Potable Water Specifications, Standard Practices, for the standards applicable to water used to clean the engine gaspath.

NOTE: To prevent freezing, add sufficient PMC 9094 isopropyl alcohol to water up to maximum of 50 percent by volume. See Table 701.

(8) Make certain there is no N2 rotation, then, engage starter and allow N2 to reach 3000 rpm. Do not exceed starter duty cycle.

(9) Inject water into combustion section of engine through probes, at 40 - 45 psi (275.8 - 310.3 kPa) pressure, for 30 seconds.

(10) Turn water off and release starter.

(11) Allow engine to drain for approximately five minutes.

(12) Repeat steps (8) through (11) two more times.

NOTE: When only one probe is used repeat steps (8) through (11) five more times.

R (13) Remove probes and reinstall igniter plugs, packing
R holders, and igniter plug leads. Refer to
R Chapter/Section 74-22-01, Removal/Installation-00 (Task
R 74-22-01-450-001).

(14) Remove plug from fuel control Pb tube moisture trap and check for entrapped water.

(15) If engine is to remain inoperative for four hours or more after washing, start engine and run at Idle for five minutes.

NOTE: Under very cold and windy weather conditions, even if water/alcohol mixture is used, there is a high probability of ice formation in engine in less than four hours if engine run-up is not performed following wash, to purge or evaporate residual water.

NOTE: Observe N1 rpm for indication of low compressor rotation while rotating engine with starter and prior to opening fuel shutoff lever.

(16) Shut down engine and recheck fuel control Pb tube moisture trap for water. Also check Pb bellows cavity for water.

NOTE: Entrapped water in Pb bellows cavity can prevent proper engine operation.

Task 72-00-00-170-001:

3. Fuel Nozzle Cleaning

NOTE: On-wing cleaning of fuel nozzles is done to remove coke (carbon or varnish) from the internal fuel passages of the fuel nozzle and support assemblies. Coke collected in the fuel passages can cause flow blockage or a distorted spray pattern. On-wing fuel nozzle cleaning is an optional procedure. It is only necessary to do this if operator experience shows that this cleaning is necessary. A number of factors can give operators different experience with fuel nozzle condition (for example environment, fuel, overhaul practices and intervals, and build standard of an engine). Unusual damage to combustion chambers and outlet ducts, bowed 1st stage turbine vanes, or cracks or erosion in 2nd stage vanes can show that on-wing fuel nozzle cleaning is necessary to remove and prevent coke in fuel nozzles. When there is much coke in fuel nozzles, it can be necessary to add soak cycles to the procedure if the operator thinks that this is necessary. It is permitted to use the fuel nozzle cleaning procedure on an installed engine (on-wing), on an engine in a test stand, or on a partly disassembled engine in which the fuel manifolds, nozzles, and diffuser case are assembled (for example an engine with the hot section removed).

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A. Equipment And Materials Required
See Figures 701 and 702.

(1) Three gallon (minimum) capacity tank with following provisions.

(a) Capability of monitoring content level.

(b) Ability to withstand 100 psig internal pressure safely.

(c) Tank pressure relief valve preset to limit tank pressure to 60 - 65 psig.

(d) Tank pressure gage to monitor internal pressure.

(2) 200 mesh strainer at inlet of shutoff valve.

(3) Source of clean air with regulator preset to maintain tank pressure at 45 psig.

(4) Lines to connect air source to tank.

(5) Lines, fittings and a check valve to connect tank to engine at shutoff valve. If more than one engine is to be cleaned at one time, provide a separate set of lines, fittings and check valve for each engine. Connect tank to each engine sequentially. Function of check valve is to maintain lines to each engine full of cleaning fluid between flow cycles. The check valve should be located at inlet end of supply line to each engine, close to shutoff valve.

(6) A time piece suitable for measuring following intervals: (approximately) ten seconds, one-half hour, and one hour.

(7) Cleaning solution. Refer to Chapter/Section 70-00-00, Cleaning/Painting-11 (Task 70-00-00-100-011), Standard Practices.

(8) shutoff valve.

(9) Fuel manifold adapter assembly or equivalent to be locally fabricated. See Figure 702.

B. Engine Preparation

(1) Remove the pressurizing and dump valve.

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(a) Disconnect the primary and secondary fuel supply manifolds from the fuel pressurizing and dump valve.

(b) Disconnect the nut from the oil cooler-to-fuel pressurizing and dump valve fuel tube at the fuel pressurizing and dump valve end.

NOTE: If necessary to remove the tube from the engine, remove the clips and three nuts that hold the fuel tube retaining plate at the rear of the oil cooler. Remove the tube from the engine after the pressurizing and dump valve is removed to prevent damage to the fuel tube.

(c) Loosen and remove the bolts that attach the valve to the engine. Remove the valve.

(2) Connect the fuel manifold adapter assembly to the ends of the cleaning fluid supply line and to the primary and secondary fuel tubes.

(3) Remove the combustion drain flexible line and combustion drain packing.

CAUTION: ALL LINES AND FITTINGS MUST BE CLEAN PRIOR TO CONNECTING TO FUEL MANIFOLD TO PRECLUDE ENTRY OF INSOLUBLE PARTICLES.

(4) Assemble the cleaning system as shown in Figure 703.

(5) Optional procedure:

(a) Do a leak check of the system with filtered potable water and inject through the cleaning system and fuel manifold to make sure that there are no leaks in the system. Repair any leaks before cleaning fluid is put in the engine.

NOTE: To prevent freezing, add sufficient alcohol to the water, up to a maximum of 50 percent by volume. Make the alcohol proportion correct for the ambient temperature where the procedure is done. See Table I in Paragraph 2, "Water Washing Of Engine".

(6) Remove the combustion chamber fuel drain packing holder and combustion chamber and turbine fan duct sealing seat.

NOTE: This procedure allows drainage of cleaning fluid from fan duct and prevents drainage into aircraft generator cooling duct.

C. Procedure

(1) Fill tank with cleaning mixture.

NOTE: To prevent freezing, add sufficient alcohol to the water up to maximum of 50 percent by volume. Make the alcohol proportion correct for the ambient temperature where the procedure is done. See Table 701 in Paragraph 2, "Water Washing Of Engine".

(2) Pre-fill supply line with cleaning fluid to ensure the volume of cleaning mixture followed in step (4) is consistent for each engine.

(3) Set and maintain pressure regulated air supply to 45 psig maximum.

(4) Flow cleaner through nozzles by opening shut-off valve for ten seconds, then close.

NOTE: Do not permit level of mixture in tank to drop to the point where air can purge cleaning mixture from fuel nozzles, as this will render subsequent soak period ineffective. This precaution is essential to success of cleaning procedure. (See also step 11.)

(5) Allow fuel nozzles to soak for one hour minimum. (If more than one engine is to be cleaned, steps (2) through (4) may be applied to another engine during this soak interval.)

(6) Repeat steps (3) and (4).

(7) Allow fuel nozzles to soak for half hour minimum.

(8) Repeat steps (3) and (4) except leaving control valve open until all cleaning fluid has been discharged from tank. Continue air purge five minutes after all fluid has been discharged.

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(9) Remove cleaning fluid from the gas path surfaces of the engine hot section by Option 1 (a) or Option 2 (b) below:

(a) Option 1: Clean the gaspath by compressor water wash.

1 Disconnect the fuel nozzle cleaning equipment and return the engine to an operational condition. Refer to step (11) before the engine fuel system is connected.

2 Water wash the engine compressor to remove cleaning fluid from gaspath surfaces. Refer to paragraph 2.

(b) Option 2: Clean the gaspath with the fuel nozzle cleaning equipment.

1 If necessary, remove remaining cleaning fluid from the tank.

2 Fill the tank (approximately three gallons) with potable water.

NOTE: To prevent freezing, add sufficient alcohol to the water, up to a maximum of 50 percent by volume. Make the alcohol proportion correct for the ambient temperature where the procedure is done. See Table I in Paragraph 2, "Water Washing Of Engine".

3 Adjust the air presssure to 45 psig maximum.

4 Open the shutoff valve and flow water through the fuel nozzles to clean the gaspath surfaces. Do not let all the water out of the tank.

5 Do steps 1 thru 4 two more times. During the last cleaning procedure, keep the shutoff valve open until all water is gone from the tank. Continue to flow air through the equipment until all water is gone.

6 Disconnect the fuel nozzle cleaning equipment and return the engine to an operational condition. Refer to step (11) before the engine fuel sytem is connected.

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(10) Before returning engine to service, leak check engine fuel system in accordance with Test C.

NOTE: Under very cold weather conditions, even if water/alcohol mixture is used, there is high probability of ice formation in engine in less than four hours if engine run-up is not performed following wash procedure to purge or evaporate residual water.

(11) Upon completion of the procedure, or if the procedure is interrupted, residual cleaning fluid should not be allowed to remain in internal fuel system passages for a period greater than 24 hours as this could result in surface corrosion of passages. To prevent corrosion, either:

(a) Start engine and do the check in step (10). Check for leaks at P&D valve as is normal procedure after any fuel system plumbing removal, or

(b) Flow Jet A fuel or kerosene into primary and secondary fuel tubes per paragraph E. Fuel Manifold Purge Procedure.

D. Alternate JT8D Fuel Nozzle Cleaning Procedure Using JT9D Cleaning Cart Equipment.

NOTE: This alternate procedure is for use with JT9D fuel nozzle cleaning carts built to PWA Specification Nos. CTE 5092 and CTE 5093.

CAUTION: AT NO TIME DURING CLEANING SHALL SECONDARY PRESSURE BE GREATER THAN PRIMARY PRESSURE. PRESSURE IN PRIMARY AND SECONDARY MANIFOLDS MUST BE EQUAL TO PRECLUDE DAMAGE TO NOZZLE SEAL.

(1) Connect JT9D cleaning cart to JT8D primary and secondary tubes using PWA 33770 Primary Adapter and PWA 33771 Secondary Adapter, or equivalent. Ensure fluid delivery system be leak free per step B.(7).

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(2) Charge cleaning tank with cleaning fluid mixture defined in step A.(7). Charge rinse tank with potable water (no more than 10 ppm of chlorides).

NOTE: To prevent freezing, add sufficient alcohol to water up to maximum of 50 percent by volume. See Table 701 in Paragraph 2, "Water Washing Of Engine".

(3) Flow a total of 20 gallons of solution through the nozzle primary and secondary passages using a cycle consisting of five second spraying period (on) and a 180 second soaking period (off). Approximately 20 - 25 cycles will be required to flow 20 gallons of solution through nozzles.

(4) Upon completion of step D.(3), rinse residual cleaning fluid from gaspath surfaces of hot section by flowing a minimum of six gallons from rinse tank through nozzles.

NOTE: Alternatively, this step may be omitted if compressor water wash will be accomplished per step C.(10) as part of step D.(5).

(5) Do step C.(9) if D.(4) was not done, and C.(10) if necessary, of the basic JT8D cleaning procedure.

E. Fuel Manifold Purge Procedure

(1) Flow Jet A fuel through fuel system to clear water and preserve nozzles:

(a) Disconnect cleaning cart from fuel manifold adapter assembly.

(b) Close engine fuel supply shut-off valve.

(c) Install a number 6 fitting and preformed packing in engine driven fuel pump Fuel Press 1 port.

(d) Connect a number 6 flexible line to the Fuel Press 1 fitting and to fuel manifold adapter assembly through an appropriate fitting (number 16 to 6 reducer).

(e) Pull out ignition circuit breakers and open engine fuel supply shut-off valve.

(f) Turn on aircraft boost pump for 10 - 15 seconds.

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(g) Allow engine to drain.

(h) Close engine fuel supply shut-off valve.

(2) Disconnect fuel purge line from engine driven pump and fuel manifold adapter assembly. Reinstall pump port plug with new lubricated packing and safety wire.

(3) Disconnect fuel manifold adapter assembly from primary and secondary fuel tubes.

(4) Remove primary and secondary fuel manifolds.

(5) Install oil cooler-to-fuel pressurizing and dump valve if removed.

(a) Install new packings (lightly coated with PWA 36500 Assembly Fluid) and retainers.

(b) Secure to rear of oil cooler with tube retaining plate and three locknuts.

(6) Position dump valve on engine and secure it with washers and bolts.

NOTE: Use washers and locknuts for stud type installation.

(7) Secure oil cooler-to-fuel pressurizing and dump valve tube.

(8) Position primary and secondary fuel manifolds on engine, secure to both fuel inlet tube ends and pressurizing and dump valve. Use new packings (lightly coated with PWA 36500 Assembly Fluid) and retainers.

(9) Install combustion drain packing.

(10) Install combustion drain flexible line. See airframe manual for installation of fittings and drain line.

(11) Close ignition circuit breakers.

(12) Open engine fuel supply shut-off valve.

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Task 72-00-00-170-002:

R 4. Engine Cleaning After Chemical Contact With Fire Extinguishing
R Agents, Hydraulic Fluid, Oil Or Fuel

A. Procedure

(1) General

R (a) SPOP 425 provides information in determining
R appropriate actions for engines that have come
R in contact with fire extinguishing agents,
R hydraulic fluid, oil or fuel. Refer to
R Chapter/Section 70-00-00, Cleaning/Painting-01
R (Task 70-00-00-100-001), Standard Practices.

Task 72-00-00-170-003:

5. External Engine Cleaning

A. Procedure

R (1) General

R (a) Refer to SPOP 1 in Chapter/Section 70-00-00,
R Cleaning/Painting-02 (Task 70-00-00-100-002),
R Standard Practices. This SPOP gives procedures to
R degrease engine externals.

R (b) Refer to SPOP 6 in Chapter/Section 70-00-00,
R Cleaning/Painting-20 (Task 70-00-00-100-020),
R Standard Practices. This SPOP has procedures to
R clean electrical wiring harnesses and contact
R points..

Task 72-00-00-990-001:

6. Numerical Tool List

A. Special Tools:

R	PWA 33382	Spray Ring (Optional)
	PWA 33594	Water Wash Probe
	PWA 33770	Primary Fuel Manifold Adapter
	PWA 33771	Secondary Fuel Manifold Adapter
R	PWA 83298	Distributor (With Hoses Sufficient To Give
R		15 Gallons per Minute Flow) (Optional)
R	PWA 86516	Basic Cart (Gasoline Powered Pump)
R		(Optional)
R	PWA 86517	Basic Cart (Electric Powered Pump)
R		(Optional)
R	PWA 86527	Basic Cart (Gasoline Powered Pump And

(CONTINUED)

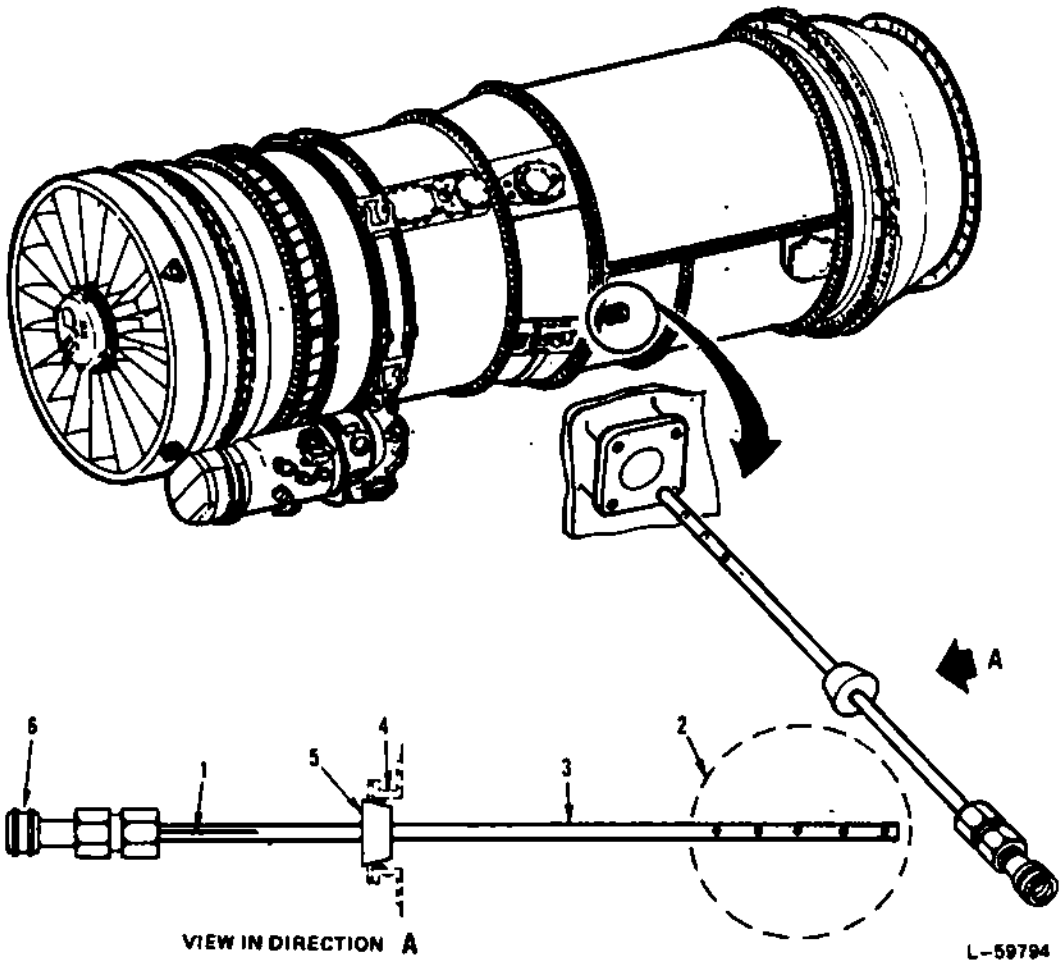
R		Nitrogen Supply System) (Optional)
R	PWA 86528	Basic Cart (Electric Powered Pump And
R		Nitrogen Supply System) (Optional)
R	PWA 102995	Water Wash Nozzle (Optional)
R	PWA 104744	Water Wash Cart (Electric Powered Pump)
R		(Optional)

R NOTE: Experience has shown that the local water supply pressure will give sufficient flow for the water wash procedure. The optional carts are only necessary if you use alcohol or detergent, or there is no clean local water supply at the wash site.

R B. Consumable Materials:

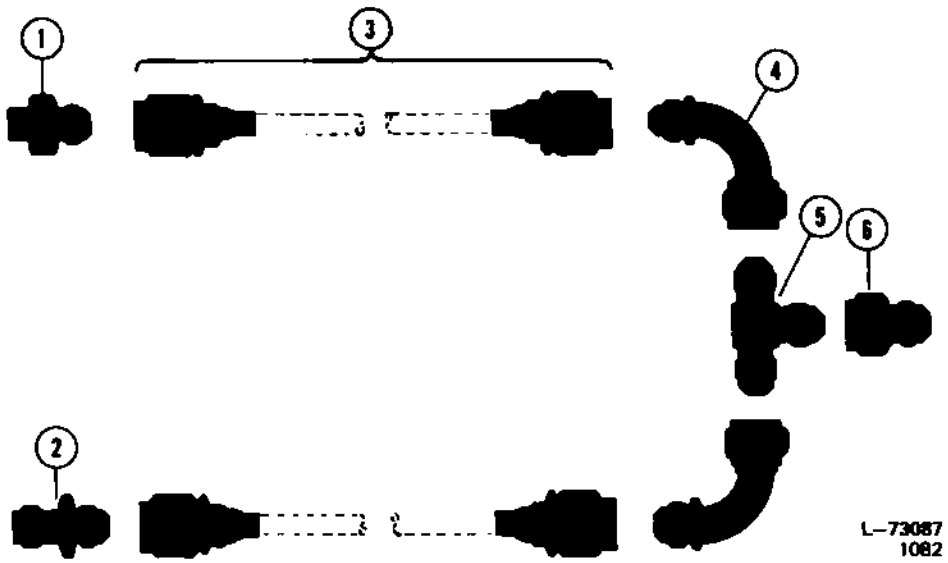
R	Potable Water	Refer to Standard Practices, Chapter/Section 70-00-00, Cleaning/ Painting-10, for potable water specifications
R	PMC 9094* Isopropyl Alcohol	Refer to Standard Practices, Chapter/Section 70-30-00, Standard Practices-01.
R	SPMC 87 Gaspath Cleaner	Refer to Standard Practices, Chapter/Section 70-30-00, Standard Practices-01.
R	SPMC 148 Cleaner, Wipe	Refer to Standard Practices, Chapter/Section 70-30-00, Standard Practices-01.
R		Clean shop air or nitrogen to remove water from tubes

R *Required at ambient temperatures below 40°F (4.4°C)



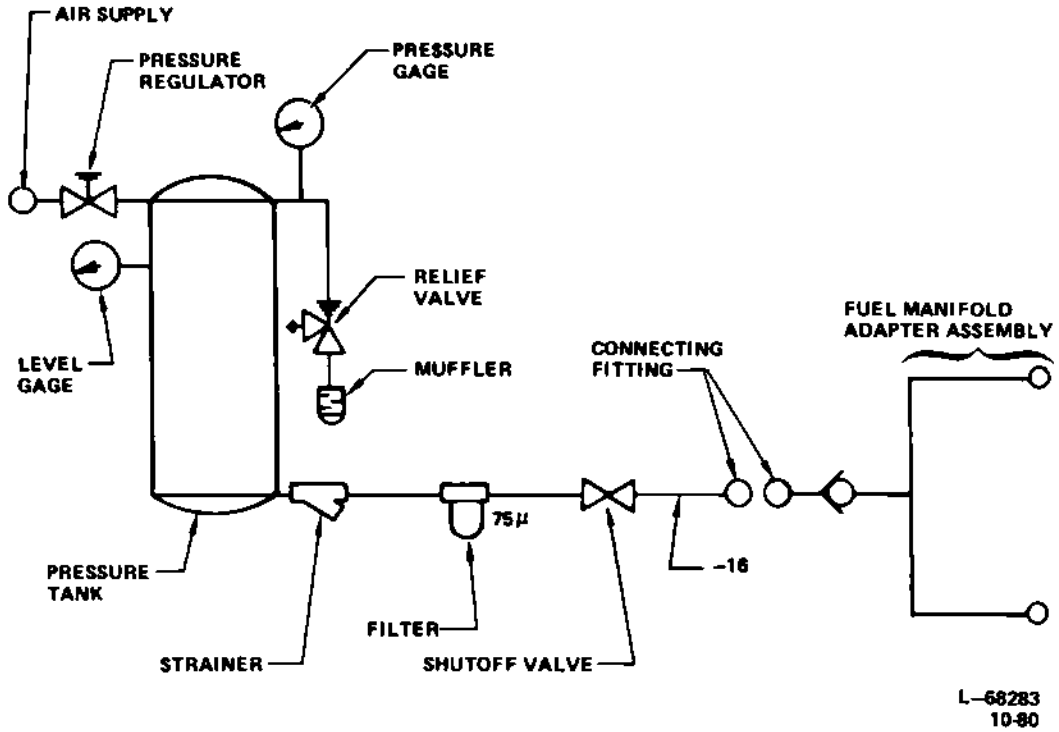
1. Black Scribed Line (Facing To Rear Of Engine)
2. Combustion Chamber (Reference)
3. Water Wash Probe Tube
4. Igniter Plug Boss On Fan Duct
5. Rubber Stopper
6. Hose Connector

R Turbine Section Water
R Wash Probe Installation
Figure 701
(Task 72-00-00-990-001)

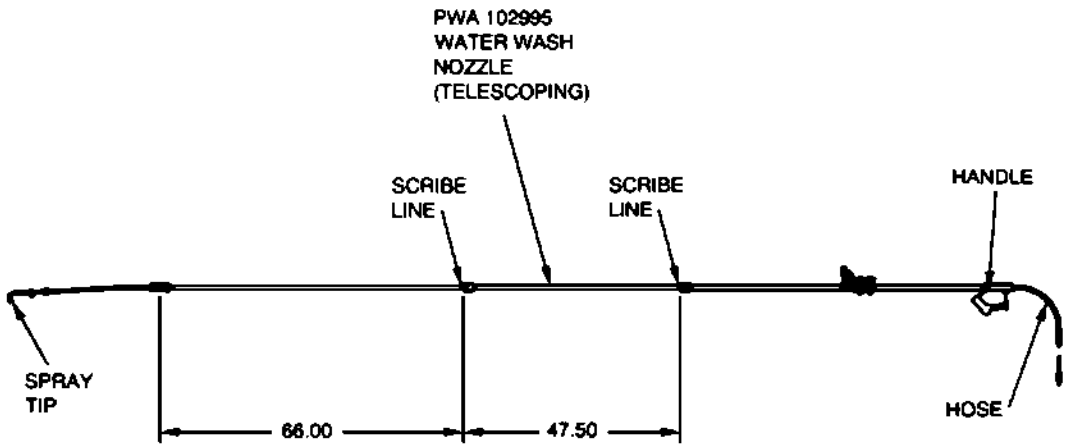


ITEM	INDENT.	QUANT.	P/N	VENDOR
1	ADAPTER, PRIMARY	1	PWA 33770	PWA
2	ADAPTER, SECONDARY	1	PWA 33771	PWA
3	INTERCONNECTING HOSE	2	M666000-12-0180	AEROQUIP CORP.
	HOSE	2	666-12-0180	AEROQUIP CORP.
	FITTINGS	4	F66826-12	AEROQUIP CORP.
4	SWIVEL ELBOW	2	FF5163TA-1212S	AEROQUIP CORP.
5	TEE FITTING	1	2033TA-12-12S	AEROQUIP CORP.
6	FITTING, STRAIGHT (INTERNAL REDUCES)	1	2215TA-16-12S	AEROQUIP CORP.

R Fuel Manifold Adapter Assembly
R Figure 702
(Task 72-00-00-990-001)

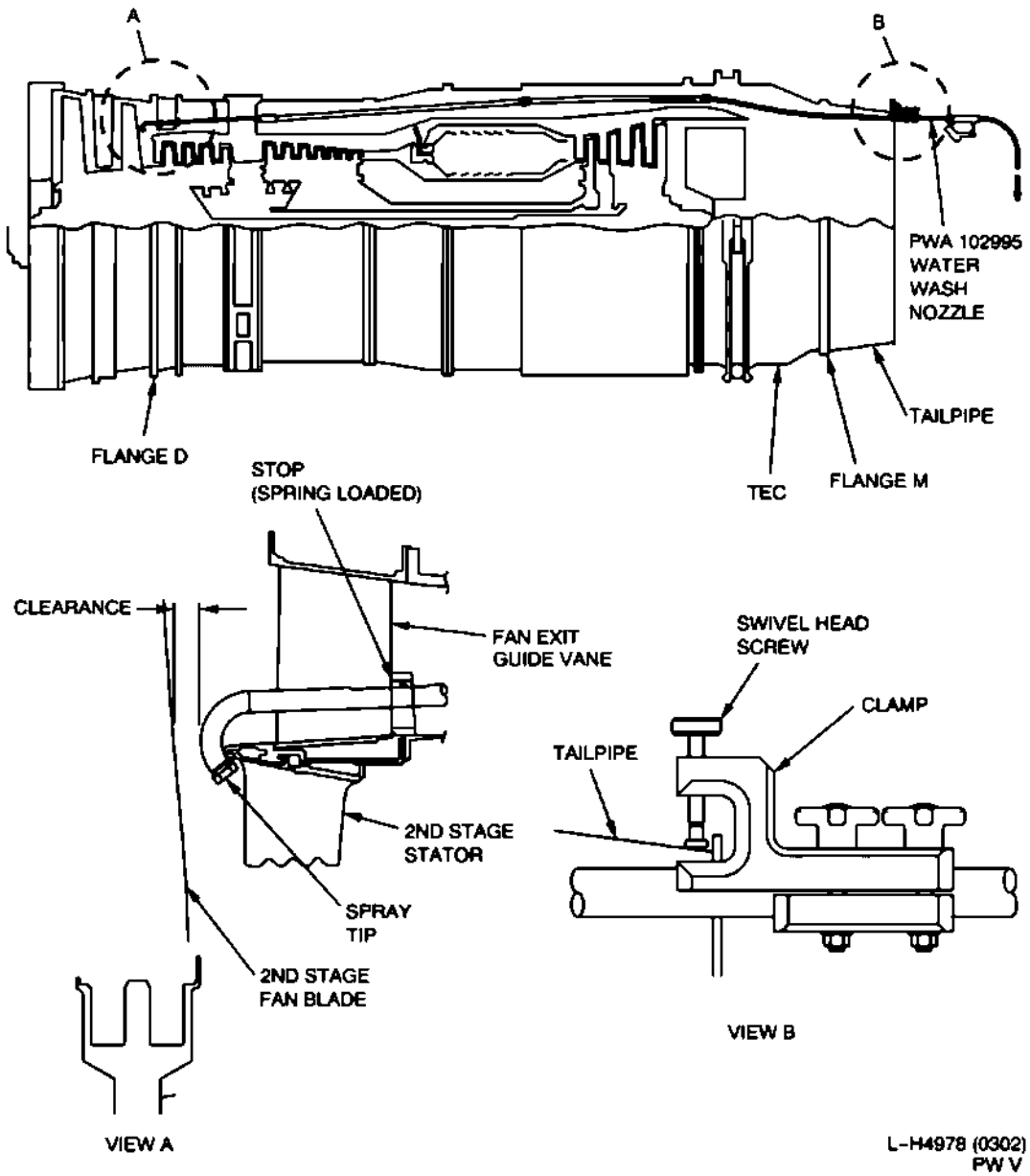


R Fuel Nozzle Cleaning
R Equipment Diagram
Figure 703
(Task 72-00-00-990-001)



L-H4977 (0302)
PW V

PWA 102995 Water Wash
Nozzle Calibration
Figure 704
(Task 72-00-00-990-001)



PWA 102995 Water Wash
Nozzle Installation
Figure 705
(Task 72-00-00-990-001)

Pratt & Whitney
JT8D MAINTENANCE MANUAL (PN 481671)

Please insert the revised pages into this manual and delete obsoleted pages in accordance with the following List of Effective Pages. Revised pages are indicated by the letter "R", added pages by the letter "A", and deleted pages by the letter "D". Superseded pages shall be removed and destroyed.

The List of Effective Pages records not only each page of subject revision but also each previously issued page which is still current. Blank pages and pages which are no longer current do not appear on this list. If there is any question about the currency of the maintained copy, it is recommended that each page of the manual be checked off against this List of Effective Pages. Any page which does not check out with this list, either by number or by date, shall be discarded. This list is reissued in its entirety whenever this manual section is revised.

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List of Effective Pages - 72 - Engine
See end of list.

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	010		OCT 15/02
	011		OCT 15/02
	012		OCT 15/02
	013		OCT 15/02
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	015		OCT 15/02
	016		OCT 15/02
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	019		OCT 15/02
	020		OCT 15/02
	021		OCT 15/02
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	025		OCT 15/02
	026		OCT 15/02
	027		OCT 15/02

	028		OCT 15/02
	029		OCT 15/08
	030		OCT 15/08
	031		APR 15/08
	032		APR 15/08
	033		APR 15/08
	034		APR 15/08
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	036		APR 15/08
	037		APR 15/08
	038		APR 15/08
	039		APR 15/08
	040		APR 15/08
	041		APR 15/08
	042		APR 15/08
	043		APR 15/08
	044		APR 15/08
	045/046		APR 15/08
72-00-00			
72-00-00	101	-ALL	OCT 15/02
TBLSHOOT-01	102		OCT 15/02
	103		OCT 15/02
	104		OCT 15/02
	105/106		OCT 15/02
72-00-00			
72-00-00	101	-ALL	APR 15/07
TBLSHOOT-02	102		APR 15/07
	103		APR 15/07
	104		APR 15/07
	105		OCT 15/07
	106		OCT 15/07
	107		OCT 15/07
	108		OCT 15/07
	109		OCT 15/07
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	142		OCT 15/05
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	146		OCT 15/05
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		158		OCT 15/05
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		160		OCT 15/05
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		163		OCT 15/05
		164		OCT 15/05
		165		OCT 15/05
		166		OCT 15/05
		167		OCT 15/05
		168		OCT 15/05
72-00-00				
72-00-00		101	-ALL	OCT 15/02
	TBLSHOOT-03	102		OCT 15/02
		103		OCT 15/02
		104		OCT 15/02
		105		OCT 15/02
		106		OCT 15/02
		107		OCT 15/02
		108		OCT 15/02
		109		OCT 15/02
		110		OCT 15/02
		111		OCT 15/02
		112		OCT 15/02
		113		OCT 15/02
		114		OCT 15/02
		115		OCT 15/02
		116		OCT 15/02
72-00-00				
72-00-00		101	-ALL	OCT 15/04
	TBLSHOOT-04	102		OCT 15/04
		103		OCT 15/02
		104		OCT 15/02
	R	105		OCT 15/09
	R	106		OCT 15/09
	R	107		OCT 15/09
	R	108		OCT 15/09
	R	109		OCT 15/09
	R	110		OCT 15/09
	R	111		OCT 15/09
	R	112		OCT 15/09
	R	113		OCT 15/09
	R	114		OCT 15/09
	R	115		OCT 15/09
	R	116		OCT 15/09
	R	117		OCT 15/09
	R	118		OCT 15/09
		119		OCT 15/08
		120		OCT 15/08
		121		OCT 15/08
		122		OCT 15/08
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		124		OCT 15/08
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		131		OCT 15/08
		132		OCT 15/08
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	146		OCT 15/08
	147		OCT 15/08
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	185		OCT 15/08
	186		OCT 15/08
	187		OCT 15/08
	188		OCT 15/08
	189		OCT 15/08
	190		OCT 15/08
	190A		OCT 15/08
	190B		OCT 15/08
	190C		OCT 15/08
	190D		OCT 15/08
	190E/190F		OCT 15/08
72-00-00			
72-00-00	101	-ALL	OCT 15/02
TBLSHOOT-05	102		OCT 15/02
	103		OCT 15/02
	104		OCT 15/02
	105		OCT 15/02
	106		OCT 15/02
	107		OCT 15/02
	108		OCT 15/02

72-00-00	301	-ALL	APR 15/06
SERVCNG-00	302		APR 15/06
	303		APR 15/08
	304		APR 15/08
	305		APR 15/08
	306		APR 15/08
	307		APR 15/08
	308		APR 15/08
	309		APR 15/08
	310		APR 15/08
	311		APR 15/08
	312		APR 15/08
	313		APR 15/06
	314		APR 15/06
	315		OCT 15/08
	316		OCT 15/08
	317		APR 15/06
	318		APR 15/06
	319		APR 15/06
	320		APR 15/06
	321		APR 15/06
	322		APR 15/06
	323		APR 15/08
	324		APR 15/08
	325		APR 15/06
	326		APR 15/06
	327		APR 15/06
	328		APR 15/06
	329		APR 15/06
	330		APR 15/06
	331		APR 15/06
	332		APR 15/06
	333		APR 15/06
	334		APR 15/06
	335		APR 15/07
	336		APR 15/07
	337/338		APR 15/07
72-00-00			
72-00-00	401	-ALL	OCT 15/02
REM/INST-00	402		OCT 15/02
72-00-00			
72-00-00	501	-ALL	OCT 15/05
ADJ/TEST-01	502		OCT 15/05
	503		OCT 15/05
	504		OCT 15/05
	505		OCT 15/02
	506		OCT 15/02
	507		OCT 15/02
	508		OCT 15/02
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	512		OCT 15/02
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	514		OCT 15/02
	515		OCT 15/05
	516		OCT 15/05
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	524		OCT 15/02
	525		OCT 15/05
	526		OCT 15/05
	527		APR 15/06
	528		APR 15/06
	529		APR 15/06
	530		APR 15/06
	531		OCT 15/07

	532	OCT 15/07
	533	OCT 15/07
	534	OCT 15/07
	535	OCT 15/07
	536	OCT 15/07
	537	OCT 15/07
	538	OCT 15/07
	539	OCT 15/07
	540	OCT 15/07
	541	APR 15/06
	542	APR 15/06
	543	APR 15/06
	544	APR 15/06
	545	APR 15/06
	546	APR 15/06
R	547	OCT 15/09
R	548	OCT 15/09
R	549	OCT 15/09
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	559	OCT 15/06
	560	OCT 15/06
	561	OCT 15/06
	562	OCT 15/06
	563	APR 15/09
	564	APR 15/09
	565	OCT 15/06
	566	OCT 15/06
	567	OCT 15/06
	568	OCT 15/06
	569	OCT 15/06
	570	OCT 15/06
	571	OCT 15/06
	572	OCT 15/06
	573	APR 15/07
	574	APR 15/07
	575	OCT 15/06
	576	OCT 15/06
	577	OCT 15/08
	578	OCT 15/08
	579	OCT 15/06
	580	OCT 15/06
	581	OCT 15/06
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	584	OCT 15/06
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	586	OCT 15/06
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	588	OCT 15/06
	589	OCT 15/06
	590	OCT 15/06
	590A	OCT 15/06
	590B	OCT 15/06
	590C	OCT 15/06
	590D	OCT 15/06
	590E	OCT 15/06
	590F	OCT 15/06
	590G	OCT 15/06
	590H	OCT 15/06
	590I	OCT 15/06
	590J	OCT 15/06
	590K	OCT 15/06
	590L	OCT 15/06
	590M	OCT 15/06

	590N		OCT 15/06
	590O		OCT 15/06
	590P		OCT 15/06
	590Q		OCT 15/06
	590R		OCT 15/06
	590S		OCT 15/06
	590T		OCT 15/06
	590U		OCT 15/06
	590V		OCT 15/06
	590W		OCT 15/06
	590X		OCT 15/06
	590Y		OCT 15/06
	590Z		OCT 15/06
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	592B		OCT 15/06
	592C		OCT 15/06
	592D		OCT 15/06
	592E		OCT 15/06
	592F		OCT 15/06
	592G		OCT 15/06
	592H		OCT 15/06
	592I		OCT 15/06
	592J		OCT 15/06
	592K		OCT 15/06
	592L		OCT 15/06
	592M		OCT 15/06
	592N		OCT 15/06
	592O		APR 15/09
	592P		APR 15/09
	592Q		OCT 15/06
	592R		OCT 15/06
	592S		OCT 15/06
	592T		OCT 15/06
	592U		OCT 15/06
	592V		OCT 15/06
	592W		OCT 15/06
	592X		OCT 15/06
	592Y		OCT 15/06
	592Z		OCT 15/06
	593		OCT 15/06
	594		OCT 15/06
	594A		OCT 15/06
	594B		OCT 15/06
	594C		OCT 15/06
	594D		OCT 15/06
	594E		OCT 15/06
	594F		OCT 15/06
	594G		OCT 15/06
	594H		OCT 15/06
	594I		OCT 15/06
	594J		OCT 15/06
	594K		OCT 15/06
	594L		OCT 15/06
	594M		OCT 15/06
	594N		OCT 15/06
	594O		OCT 15/06
	594P		OCT 15/06
	594Q		OCT 15/06
	594R		OCT 15/06
	594S		OCT 15/08
	594T		OCT 15/08
	594U/594V		OCT 15/08
72-00-00			
72-00-00	501	-ALL	OCT 15/02
ADJ/TEST-02	502		OCT 15/02
	503		OCT 15/02
	504		OCT 15/02
	505		OCT 15/02
	506		OCT 15/02
	507		OCT 15/02

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	531		OCT 15/02
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	538		OCT 15/02
	539		OCT 15/02
	540		OCT 15/02
72-00-00			
72-00-00	601	-ALL	OCT 15/02
INSP/CK-01	602		OCT 15/02
	603		OCT 15/02
	604		OCT 15/02
	605		OCT 15/02
	606		OCT 15/02
	607		OCT 15/02
	608		OCT 15/02
	609		APR 15/06
	610		APR 15/06
	611		OCT 15/02
	612		OCT 15/02
	613		OCT 15/02
	614		OCT 15/02
	615		OCT 15/02
	616		OCT 15/02
	617		OCT 15/02
	618		OCT 15/02
	619		OCT 15/02
	620		OCT 15/02
	621		APR 15/08
	622		APR 15/08
	623		OCT 15/03
	624		OCT 15/03
	625		OCT 15/03
	626		OCT 15/03
	627		APR 15/06
	628		APR 15/06
	629		APR 15/06
	630		APR 15/06
	631		OCT 15/02
	632		OCT 15/02
	633		OCT 15/02
	634		OCT 15/02
	635		OCT 15/02
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	637		OCT 15/02
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690A	OCT 15/08
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690C	OCT 15/08
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690E	OCT 15/08
690F	OCT 15/08
690G	OCT 15/08
690H	OCT 15/08
690I	OCT 15/08
690J	OCT 15/08
690K	OCT 15/08
690L	OCT 15/08
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690S	OCT 15/08
690T	OCT 15/08

	690U		OCT 15/08
	690V		OCT 15/08
	690W		OCT 15/08
	690X		OCT 15/08
	690Y		OCT 15/08
	690Z		OCT 15/08
	691		OCT 15/08
	692		OCT 15/08
	692A		OCT 15/08
	692B		OCT 15/08
	692C		OCT 15/08
	692D		OCT 15/08
	692E		OCT 15/08
	692F		OCT 15/08
	692G		OCT 15/08
	692H		OCT 15/08
	692I		OCT 15/08
	692J		OCT 15/08
	692K		OCT 15/08
	692L		OCT 15/08
	692M		OCT 15/08
	692N		OCT 15/08
	692O		OCT 15/08
	692P		OCT 15/08
72-00-00			
72-00-00	601	-ALL	OCT 15/03
INSP/CK-02	602		OCT 15/03
	603		OCT 15/02
	604		OCT 15/02
	605		OCT 15/02
	606		OCT 15/02
	607		OCT 15/02
	608		OCT 15/02
	609		APR 15/06
	610		APR 15/06
	611		OCT 15/02
	612		OCT 15/02
	613		OCT 15/02
	614		OCT 15/02
	615		APR 15/06
	616		APR 15/06
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	628		OCT 15/02
	629		OCT 15/02
	630		OCT 15/02
	631		OCT 15/02
	632		OCT 15/02
72-00-00			
72-00-00	701	-ALL	OCT 15/06
CLEANING-00	702		OCT 15/06
	703		OCT 15/06
	704		OCT 15/06
	705		OCT 15/06
	706		OCT 15/06
	707		OCT 15/06
	708		OCT 15/06
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	710		OCT 15/06
	711		OCT 15/06
	712		OCT 15/06
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	714		OCT 15/06

	715		OCT 15/06
	716		OCT 15/06
	717		OCT 15/06
	718		OCT 15/06
	719		OCT 15/06
	720		OCT 15/06
	721		OCT 15/06
	722		OCT 15/06
	723		OCT 15/06
	724		OCT 15/06
	725		OCT 15/06
	726		OCT 15/06
	727		OCT 15/06
	728		OCT 15/06
	729		OCT 15/06
	730		OCT 15/06
	731		OCT 15/06
	732		OCT 15/06
72-09-70			
72-09-70	001/002	-ALL	OCT 15/02
DESCRIPT-00			
72-09-70			
72-09-70	401	-ALL	OCT 15/02
REM/INST-00	402		OCT 15/02
	403		OCT 15/02
	404		OCT 15/02
	405		OCT 15/02
	406		OCT 15/02
	407		OCT 15/02
	408		OCT 15/02
72-20-00			
72-20-00	001/002	-ALL	OCT 15/02
DESCRIPT-00			
72-20-00			
72-20-00	201	-ALL	OCT 15/02
MNT PRAC-00	202		OCT 15/02
	203		APR 15/06
	204		APR 15/06
	205		APR 15/06
	206		APR 15/06
	207		APR 15/06
	208		APR 15/06
	209		OCT 15/02
	210		OCT 15/02
	211		OCT 15/02
	212		OCT 15/02
	213		OCT 15/02
	214		OCT 15/02
72-20-00			
72-20-00	601	-ALL	OCT 15/02
INSP/CK-00	602		OCT 15/02
72-21-00			
72-21-00	001/002	-ALL	OCT 15/02
DESCRIPT-00			
72-21-00			
72-21-00	201	-ALL	APR 15/09
MNT PRAC-00	202		APR 15/09
	203		APR 15/09
	204		APR 15/09
	205		OCT 15/02
	206		OCT 15/02
72-21-00			
72-21-00	601	-ALL	OCT 15/02
INSP/CK-00	602		OCT 15/02
	603		OCT 15/02
	604		OCT 15/02
	605		APR 15/06
	606		APR 15/06
	607		APR 15/06
	608		APR 15/06
	609		APR 15/06
	610		APR 15/06

	611		APR 15/06
	612		APR 15/06
	613		APR 15/06
	614		APR 15/06
	615		APR 15/06
	616		APR 15/06
	617		APR 15/06
	618		APR 15/06
	619		APR 15/06
	620		APR 15/06
	621		APR 15/06
	622		APR 15/06
	623		APR 15/06
	624		APR 15/06
	625/626		APR 15/06
72-23-01			
72-23-01	001	-ALL	OCT 15/02
DESCRIPT-00	002		OCT 15/02
72-23-01			
72-23-01	201	-ALL	APR 15/03
MNT PRAC-00	202		APR 15/03
72-23-02			
72-23-02	001/002	-ALL	OCT 15/02
DESCRIPT-00			
72-30-00			
72-30-00	001	-ALL	OCT 15/02
DESCRIPT-00	002		OCT 15/02
	003/004		OCT 15/02
72-30-00			
72-30-00	201	-ALL	OCT 15/02
MNT PRAC-00	202		OCT 15/02
	203		OCT 15/02
	204		OCT 15/02
	205		APR 15/03
	206		APR 15/03
	207		OCT 15/02
	208		OCT 15/02
	209		OCT 15/02
	210		OCT 15/02
	211		APR 15/03
	212		APR 15/03
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TO: RECIPIENTS OF JT8D MAINTENANCE MANUAL, PART NUMBER 481671

REVISION NO. 138 DATED OCTOBER 15, 2009

HIGHLIGHTS - 72 - ENGINE

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72-00-00 TBLSHOOT-04	106	Removed from paragraph D, step referencing slow acceleration. (PSAF 08HC156)	-ALL
72-00-00 ADJ/TEST-01	547 -548	Revised Tt7 spread check limits. (CACTUS R9040-Q55330)	-ALL
72-34-08 REPAIR-00	802 -803	Corrected fan duct repair rivet number. (Editorial)	-ALL
72-60-00 REM/INST-00	407	Added flowmeter for No. 2/3 bearing oil nozzle airflow check. (CACTUS R9196-Q35825)	-ALL

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SUBJECT	CHP/SEC/SUB	PAGE	EFFECTIVITY
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Task 72-09-70-990-001:

1. Fuel Control Ps4 Tubes and Moisture Trap Description and Operation

   A. Compressor discharge pressure is conducted to the fuel control via a rear tube, a moisture trap, and a front tube. On current engines Pb (burner pressure) is conducted from a boss on the combustion chamber and turbine fan duct to the moisture trap; early engines obtain Ps4 from a boss on the diffuser outer duct. From the moisture trap compressor discharge pressure is carried to the fuel control through the fuel control front Ps4 tube.

Task 72-09-70-420-001:

1. Removal/Installation of Fuel Control Front Ps4 Tube Assembly

   A. Removal

      (1) Disconnect fuel control front Ps4 tube at moisture trap cover and fuel control, and remove tube.

   B. Installation

      (1) Connect fuel control front Ps4 tube to moisture trap and to connector on fuel control.

      (2) Torque tube nuts and lockwire.

Task 72-09-70-420-002:

2. Replacement of Moisture Trap

   A. Removal and Disassembly

      (1) Disconnect fuel control rear Pb (or Ps4) tube from elbow on moisture trap cover (underneath engine, front right side of fuel control).

      (2) Disconnect fuel control front Ps4 tube at moisture trap.

      (3) Unfasten bolts holding moisture trap and remove complete moisture trap.

   B. Assembly and Installation (Plug and Lockwire Configuration)

      CAUTION: BE SURE THAT THE DRAIN HOLE IN THE BOTTOM OF THE CONDENSATION TRAP PLUG IS NOT BLOCKED BY THE LOCKWIRE USED TO SAFETY THE PLUG TO THE TRAP (AN OPEN DRAIN HOLE IS NECESSARY TO LET WATER OUT OF THE TRAP). INSTALL LOCKWIRE THROUGH ONLY ONE SIDE OF THE PLUG, NOT FULLY ACROSS THE BOTTOM OF THE PLUG.

      (1) Place new seal on drain plug and install plug in moisture trap. Torque plug and secure with lockwire.

      (2) Mount trap assembly on front of fuel control. Torque bolts and secure with lockwire.

      (3) Connect fuel control front Ps4 tube to fuel control and moisture trap. Torque nuts and secure with lockwire.

(4) Connect fuel control rear Pb tube to elbow on moisture trap. Torque nut and secure with lockwire.

C. Assembly and Installation (Cotterpin Configuration)

(1) On engines so equipped, place new packing, coated with petrolatum, on OD groove of moisture trap cover rod.

(2) Place new packing, coated with petrolatum, on OD groove of moisture trap housing.

(3) Insert moisture trap housing straight into cover, being careful not to disrupt packings.

(4) Secure housing to cover with washer and nut.

(5) Torque nut. For engines so equipped, secure with cotter pin.

(6) Position assembled moisture trap on inboard side of fuel control. Secure trap in place with bolts. Torque bolts.

(7) Connect fuel control front Ps4 tube to moisture trap cover and to fuel control.

(8) Connect fuel control rear Pb (or Ps4) tube to elbow on moisture trap.

(9) Torque and lockwire bolts and tube nuts to secure.

Task 72-09-70-420-003:

3. Removal/Installation of Fuel Control Rear Pb Tube Assembly

A. Removal
See Figure 401.

(1) Establish clip and/or bracket locations for installation.

(2) Loosen nut at upper right quadrant of diffuser outer fan duct or combustion chamber and turbine fan duct, as applicable.

(3) Loosen nut at front end from moisture trap.

(4) Remove tube.

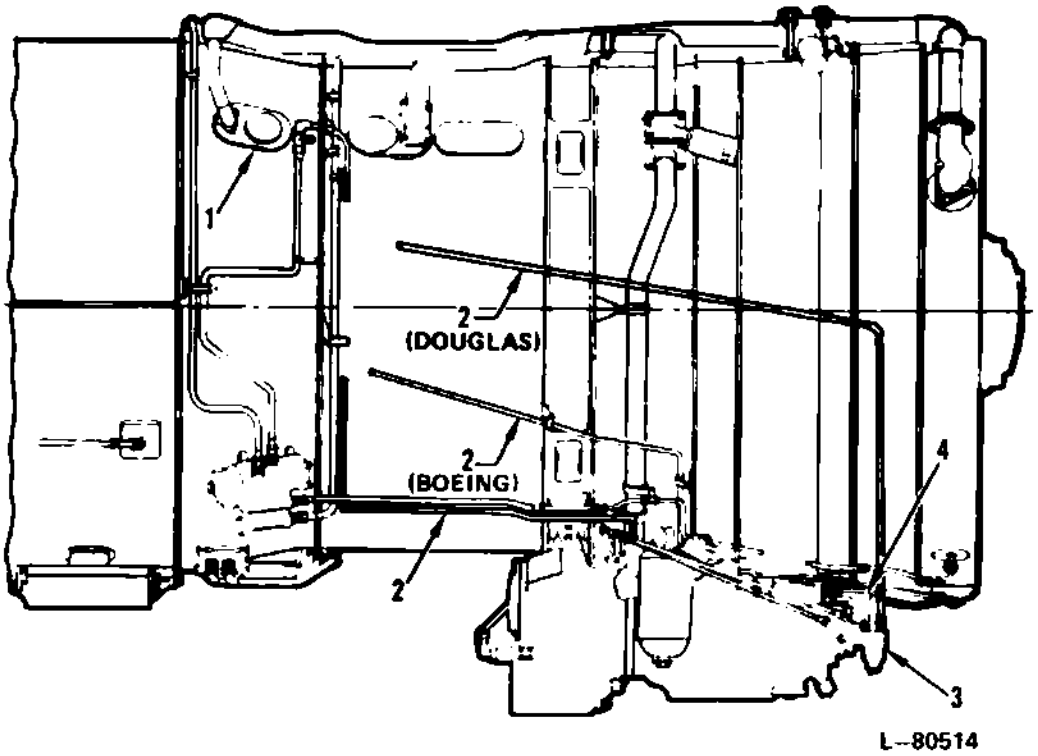
B. Installation
See Figure 401.

(1) Position tube on engine and secure nut at front to moisture trap.

(2) Secure rear nut at upper right quadrant of diffuser duct or combustion chamber and turbine fan duct, as applicable.

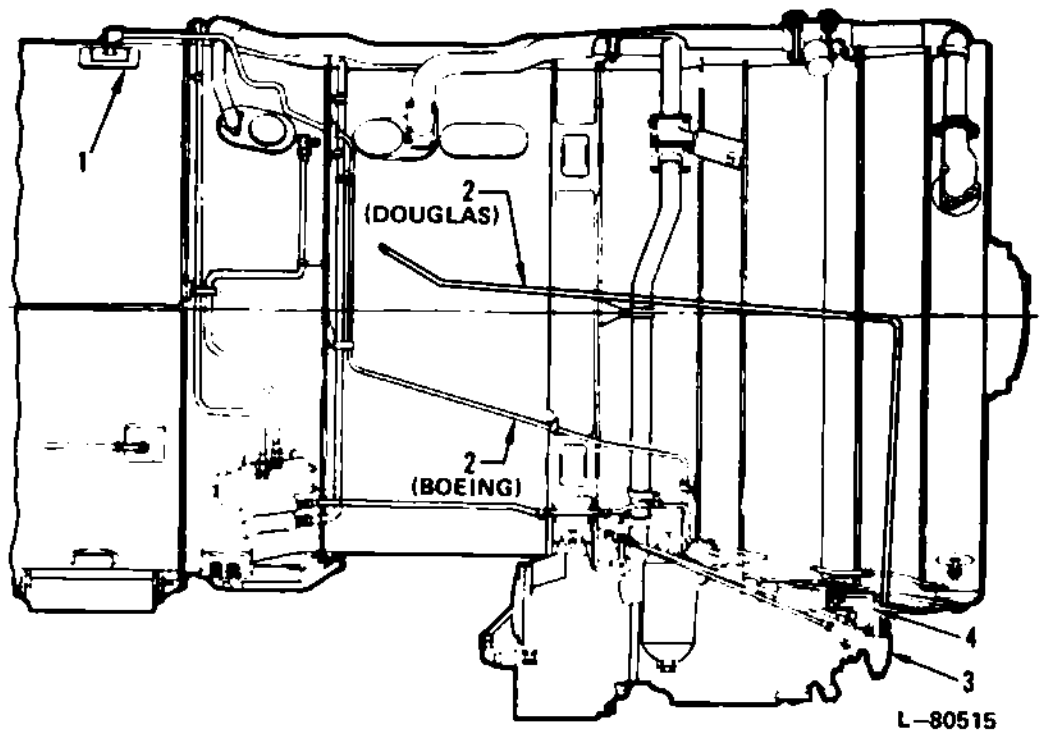
(3) Torque and lockwire nuts.

(4) Secure clips and/or brackets to tube.



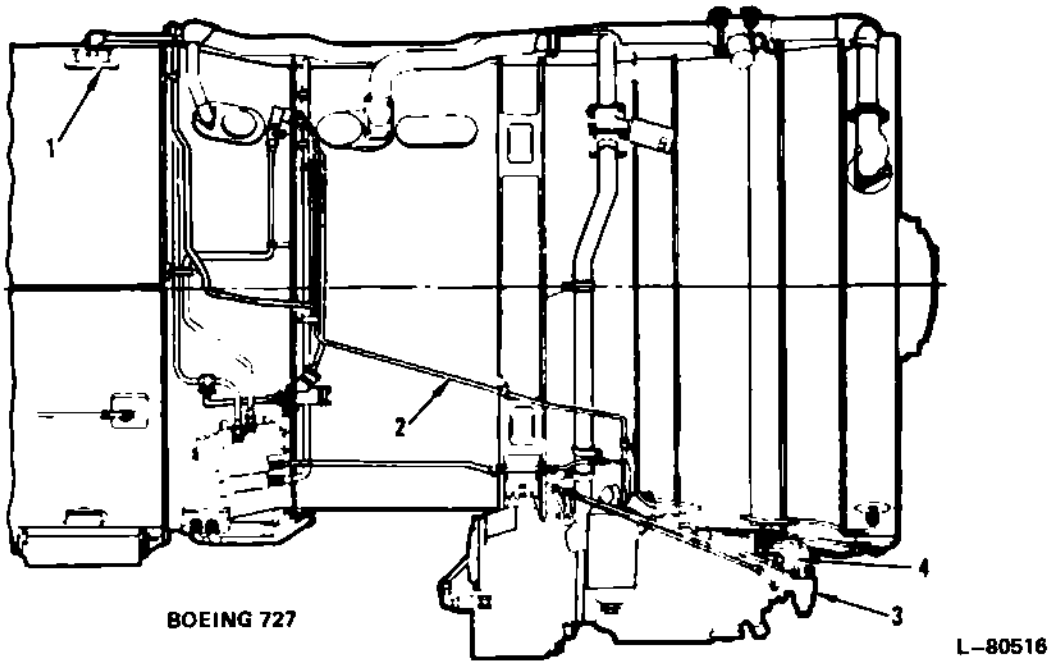
1. Diffuser Outer Fan Duct Boss
2. Fuel Control Rear Ps4 Tube
3. Moisture Trap
4. Fuel Control Front Ps4 Tube

Fuel Control Front/Rear Ps4
Tube Removal/Installation
(Prior To SB 2118)
Figure 401 (Sheet 1)
(Task 72-09-70-420-003)



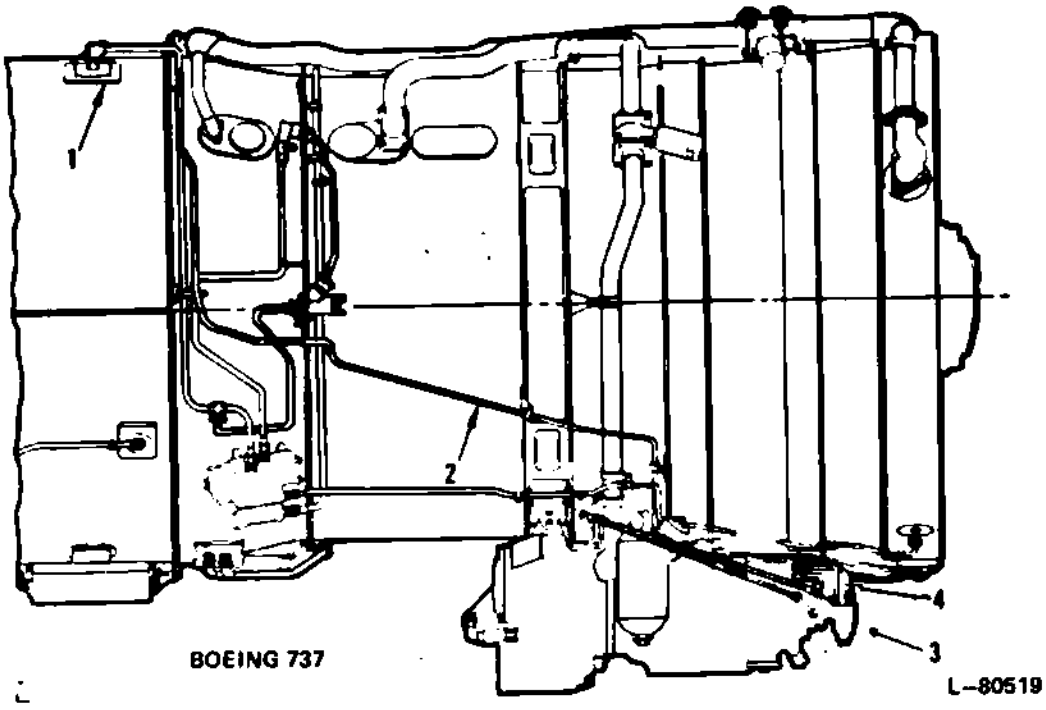
1. Combustion Chamber And Turbine Fan Duct Boss
2. Fuel Control Rear Pb Tube
3. Moisture Trap
4. Fuel Control Front Ps4 Tube

Fuel Control Front Ps4/Rear
Pb Tube Removal/Installation
(Incorporating SB 2118)
Figure 401 (Sheet 2)
(Task 72-09-70-420-003)



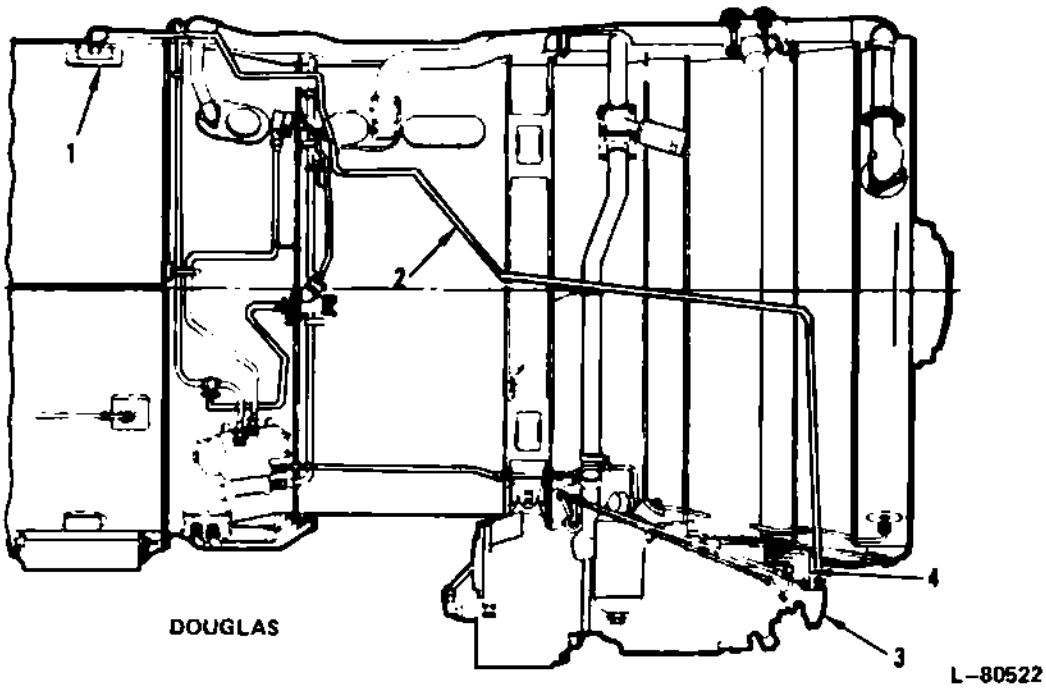
1. Combustion Chamber And Turbine Fan Duct Boss
2. Fuel Control Rear Pb Tube
3. Moisture Trap
4. Fuel Control Front Ps4 Tube

Fuel Control Front Ps4/Rear
Pb Tube Removal/Installation
(Incorporating SB 5425)
Figure 401 (Sheet 3)
(Task 72-09-70-420-003)



1. Combustion Chamber And Turbine Fan Duct Boss
2. Fuel Control Rear Pb Tube
3. Moisture Trap
4. Fuel Control Front Ps4 Tube

Fuel Control Front Ps4/Rear
Pb Tube Removal/Installation
(Incorporating SB 5425)
Figure 401 (Sheet 4)
(Task 72-09-70-420-003)



1. Combustion Chamber And Turbine Fan Duct Boss
2. Fuel Control Rear Pb Tube
3. Moisture Trap
4. Fuel Control Front Ps4 Tube

Fuel Control Front Ps4/Rear
Pb Tube Removal/Installation
(Incorporating SB 5425)
Figure 401 (Sheet 5)
(Task 72-09-70-420-003)

AIR INLET SECTION - DESCRIPTION-00

Task 72-20-00-990-002:

1. Air Inlet Section Description

A. Description

(1) The air enters the engine through the compressor inlet case which extends from flange A to B. The inlet case and its vanes, with one thicker vane at the bottom carrying engine tubing, direct air to the face of the compressor.

(2) The No. 1 bearing front support assembly is mounted in the center of the compressor inlet case. Behind the front support is the No. 1 bearing rear support. Mounted on the front of the inlet case, in the center, is the front accessory drive support.

Task 72-20-00-420-001:

1. Fan Inlet Section - Removal/Installation (Pod Mounted Engines Only)

See Figure 201.

A. Removal of Front Accessory Drive Support and No. 1 Bearing Inner Race

(1) Remove bolts securing front accessory drive support to fan inlet case.

(2) Remove the front accessory drive group from the inlet case as follows:

(a) Install the detail spacers of PWA 105043 (formerly PWA 103520) Puller on the studs of the front accessory support.

NOTE: The later PWA 103520 Puller design has spacers to install on the front accessory support studs to make it easier to remove the assembly with the puller.

(b) Use the slide hammer action of the puller to remove the front accessory support from the inlet case. Use a side to side movement with the puller and be careful to remove the front accessory support assembly straight off the inlet case without damage.

(3) Remove front accessory drive gearshaft retaining ring. Using PWA 12292 Puller, remove gearshaft.

(4) Remove rivet from No. 1 bearing inner race retaining nut.

NOTE: PWA 32766 Rivet Remover may be used for oil-damped type bearings.

(5) Remove No. 1 bearing inner race retaining nut, using PWA 14098 Wrench coupled to PWA 33732 (formerly PWA 18201 or 18872) Hydraulic Wrench (PWA 8050 Hydraulic Wrench may also be used).

(6) Shim 2nd stage fan (Reference PWA 33229 Shim).

(7) Chill hub area using dry-ice in ID.

(8) Using PWA 12225 or 32986 Puller, with PWA 29389 (formerly PWA 3755) Hydraulic Pump, remove No. 1 bearing inner race.

(9) Using PWA 12225 or 32986 Puller, with PWA 29389 (formerly PWA 3755) Hydraulic Pump, remove slinger.

(10) Using PWA 12225 or 32986 Puller, with PWA 29389 (formerly PWA 3755) Hydraulic Pump, remove No. 1 bearing seal from hub.

B. Removal Of No. 1 Bearing Outer Race

(1) Oil damped bearing outer race.

(a) Remove bolts securing outer race retaining plate to housing and remove plate.

(b) Insert jaws of PWA 32709 Puller through outer race of bearing and engage bearing rear surface with puck of puller. Engaging end of No. 1 hub, turn jackscrew and remove bearing outer race. Remove seal rings from OD of race.

(2) Non-oil damped bearing outer race.

(a) Remove rivet or lockwire (as applicable) from outer race retaining nut using PWA 33456 Rivet Remover. Unscrew and remove nut using PWA 32023 Guide, PWA 32024 Wrench (hydraulic), PWA 12670 Adapter and PWA 33732 Hydraulic Wrench.

(b) Insert jaws of PWA 12366 Puller through outer race of bearing and engage bearing rear surface. With puck of puller engaging end of No. 1 hub turn jackscrew and remove bearing outer race.

C. Removal of Fan Inlet Case

(1) Remove anti-icing air lines to fan inlet case.

(2) Remove oil and air lines and sense line to fan inlet case.

(3) Remove inlet case attaching bolts.

(4) With aid of assistant, carefully remove fan inlet case.

D. Installing Fan Inlet Case
See Figure 202.

(1) Position fan inlet case assembly, leading edges of vanes forward (over front compressor rotor front hub) onto the front of the engine.

(2) Align position pin and hole, near six o'clock position, and seat inlet case on front fan case.

(3) Reinstall and secure bolts, washers and brackets on flange "B". Torque and lockwire bolts.

NOTE: On JT8D-17R, and -17AR engines, torque Flange B bolts installed over spacers to Section
R 72-00-00, Inspection-02 (Task 72-00-00-220-001), "Fits and Clearances," Reference 1033.

NOTE: If the engine has the extended inlet configuration (refer to SB 5948, 5949, or 5950), safety cable is not permitted on the Flange B bolts (the safety cable parts will be too near aircraft electrical harnesses).

(4) On Boeing 727 engines incorporating PN 765271 or 765272 fire detection system brackets, install brackets as follows:

NOTE: Following procedure is intended to ensure that airframe flange brackets which are part of fire detection system have good electrical conductivity between each other and between brackets and engine case.

(a) Clean front fan case front flange over Index 11 distance (See Figure 202) and clean mating surfaces of airframe bracket (Index 6), fire detection bracket (Index 2), and plate spacer (Index 7).

1 Remove insoluble surface contamination, if present, from front fan case flange prior to solvent cleaning, using rotary wire brush (of AISI 302 material). Use caution while wire brushing to hold surface abrasion and loss of metal to absolute minimum.

2 Clean mating surfaces of case flange and mating bracket parts (Index 2, 6, and 7 in figure) with Stoddard Solvent, PMC 9001 to remove any grease, oil, or non-conductive film. Wipe dry immediately with lint-free cloth and assemble parts within four hours of cleaning. Omit flange bolt from Index 9 hole shown in figure.

(b) Set up four-terminal ohmmeter, connected as shown in figure at Index 12 hole in Index 2 bracket, and at Index 9 hole in case flange after parts are assembled.

NOTE: Ohmmeter accuracy shall be no less than ± 0.0002 ohm.

(c) Measure electrical resistance across case flange and mating brackets. Resistance shall not exceed 0.002 ohm (2 milliohms).

(d) When the resistance check is successfully completed, install the flange bolt in Index 9 hole. Torque the bolt and safety it with lockwire (if the engine has the extended inlet configuration, safety cable is not permitted at this flange - see the Note above).

E. Installing No. 1 Bearing Inner Race

(1) Install No. 1 bearing seal on front compressor front hub. Drift seal into position, using PWA-12015 Drift. See Front Accessory Drives Support, Section 72-23.

(2) Install No. 1 bearing oil slinger, flare inward toward the rotor, on front hub. Seat with PWA-12015 Drift.

(3) Heat No. 1 bearing inner race in hot oil and, using PWA 12015 Drift, install No. 1 bearing inner race, puller groove to front, on hub against oil slinger.

NOTE: Maintain temperature for heating engine bearings at 190° - 220°F (88° - 104°C).

CAUTION: WHEN INSTALLING PN 453382 OR 496529 INNER RACE RETAINING NUT, MAKE CERTAIN NUT IS

INSTALLED WITH EXTENDED LIP (LIP WITH OIL HOLES) INWARD TOWARD BEARING RACE.

(4) Install No. 1 bearing inner race retaining nut on front hub. Tighten it up against bearing hand tight, using PWA 12332 Wrench.

NOTE: PN 453382 or 496529 nut must be used with PN 452336 or 452337 bearings. This combination when used on front rotor hub configurations PN 491201, 496501, or 515201 requires that front accessory drives gearshaft, PN 439653, be used. On other hubs PN 484708 gearshaft must be used. PN 518795 nut is available for use with PN 452336 or 452337 bearings when PN 484708 gearshaft is used. PN 503925 or 496525 nut must be used with PN 496527 or 496528 bearings; this combination requires that gearshaft PN 484708 always be used regardless of hub configuration.

(5) Attach PWA 14098 Wrench (No. 1 bearing inner race retaining nut) to hydraulic wrench, then attach hydraulic pump.

(a) Use PWA 33732 (formerly PWA 18201 or 18872) Hydraulic Wrench with Enerpac Hydraulic Pump Model #182 (or equivalent). PWA 8050 Hydraulic Wrench may be used as an alternate.

(b) Tighten No. 1 bearing inner race retaining nut to 2000 pound-inches. Mark nut location with reference to mating part. Turn nut thru an angle of 14° min. to 17° max. Loosen nut to zero pound-inches and repeat procedure until the position of the nut, following the 2000 pound-inch torque, is the same as, or less than .065 inches beyond the mark from the preceding attempt. When this condition exists, apply final angle of 14° to 17° as described above.

(6) Install inner race retaining nut rivet, head inward. Using PWA 21598 Riveter, flare rivet.

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F. Installation Of No. 1 Bearing Outer Race And Front Accessory Drives Support
See Figures 203 and 204.

NOTE: Current No. 1 bearing is vibration-damped by oil pumped into space between outer race and housing. This type of bearing has wide outer race with seal ring groove at each end of OD. See Figure 203.

(1) If No. 1 bearing is of oil-damped type, install seal ring in groove at each end of outer race OD, with indentification-marked sides of rings facing each other. Inspect seal ring end gap and side clearance.
R Refer to Section 72-00-00, Inspection/Check-02,
R References 8 and 6. Regardless of bearing type, install race in bearing housing, serial numbers facing outward. Use drift if necessary.

(2) On earlier, non-damped bearing, secure outer race with retaining nut; using PWA 32023 Guide, PWA 32024 Wrench (Hydraulic) PWA 12670 Adapter, and PWA 33732 (formerly PWA 18201 or 18872) Hydraulic Wrench torque nut to Section 72-21-00, Inspection/Check-00, Reference 351 or Reference 1000, for JT8D-15-17). Secure retaining nut as follows:

(a) Rivet - secured outer race retaining nut: install rivet, head inward, through retaining nut and bearing housing wall and flare with PWA 6587-53 Riveter.

(b) Lockwire-secured outer race retaining nut: lockwire retaining nut in four places by installing wire between each of four bearing housings mounting bolts and hole in retaining nut closest to bolt. Begin lockwire loop at retaining nut lug, twist and secure at nearest bolthead, and secure free end of wire in lockwire hole in housing and at each bolthole.

R (3) On an oil-damped bearing, measure the fit between the
R outer race lugs and the retaining plate slots. Refer
R to Section 72-00-00, Inspection/Check-02, Reference 97.

R (4) On an oil-damped bearing, hold the outer race in position with the retaining plate. Install and torque the bolts. Do a check of the axial clearance between the retaining plate and the outer race. Refer to Section 72-00-00, Inspection/Check-02, Reference 96. Safety the bolts with lockwire.

(5) Install front accessory drive gearshaft and secure gearshaft with retaining ring.

R (6) Install four new packings, lubricated with a thin layer of PWA 36500 lubricant, on each of the transfer tubes. Install the transfer tubes in the openings in the front face of the No. 1 bearing front support.

R (7) Install two new packings, coated lightly with PWA 36500 lubricant, on the OD of the end of the inlet air pressure line connector, immediately below the nine o'clock position viewed from the front.

R (8) Install four new packings, coated lightly with PWA 36500 lubricant, on the inlet air pressure line packing holder. Install the packing holder in the opening and on the inlet air pressure line connector.

R (9) Install new packing (lubricated with a thin layer of PWA 36500 lubricant in groove around smaller front OD of No. 1 bearing front support.

(10) Install front accessory drives support assembly on front of engine, aligning two offset holes and carefully meshing gears in support with front accessory drives gearshaft.

(11) Position airframe bracket and secure support in place with washers and nuts (without washers at the bracket).

(12) Install packing in groove around front OD of No. 1 bearing front support exposed flange.

(13) Reconnect anti-icing air lines to fan inlet case.

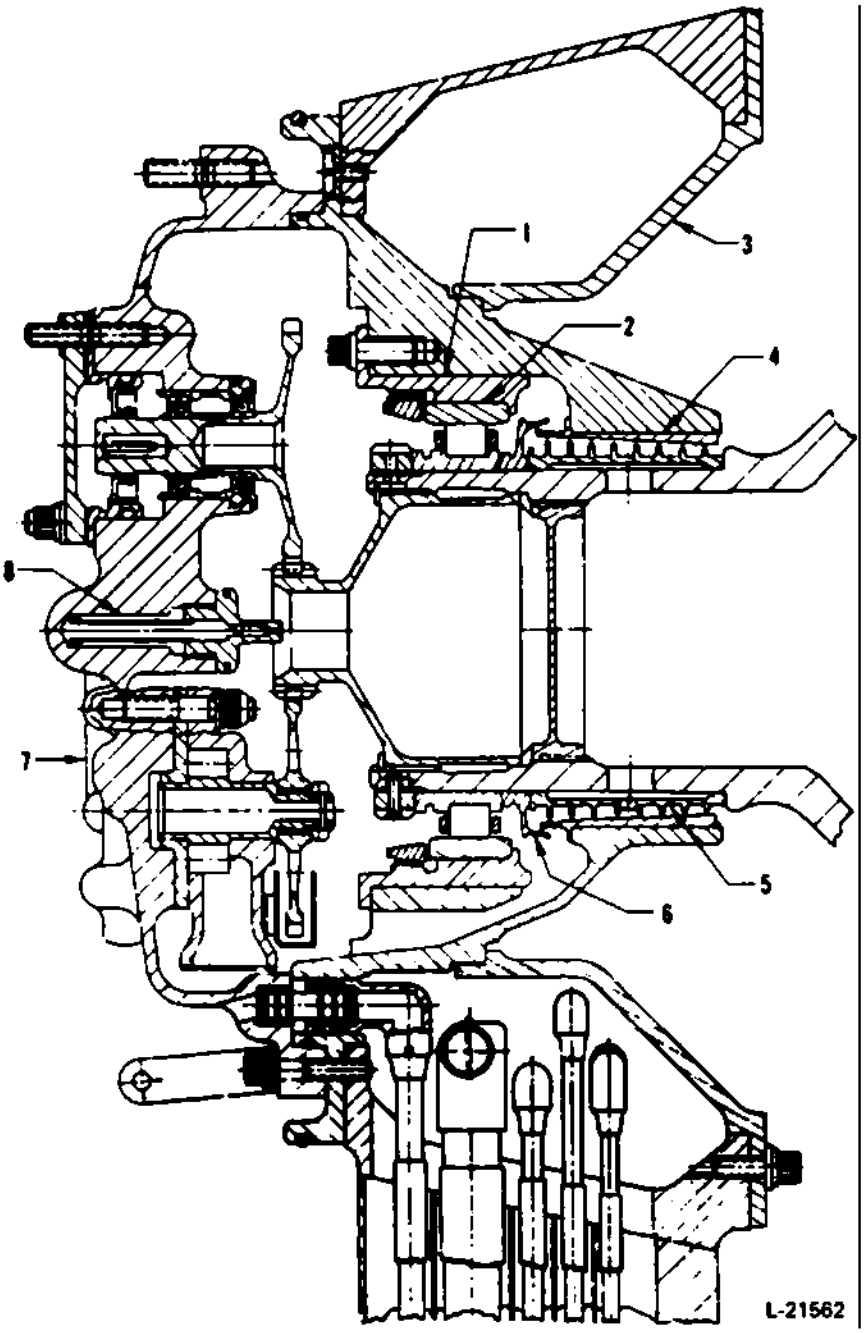
(14) Reconnect oil and air lines and sense line to fan inlet case.

Task 72-20-00-990-001:

2. Numerical Tool List

A. Numerical Tool List

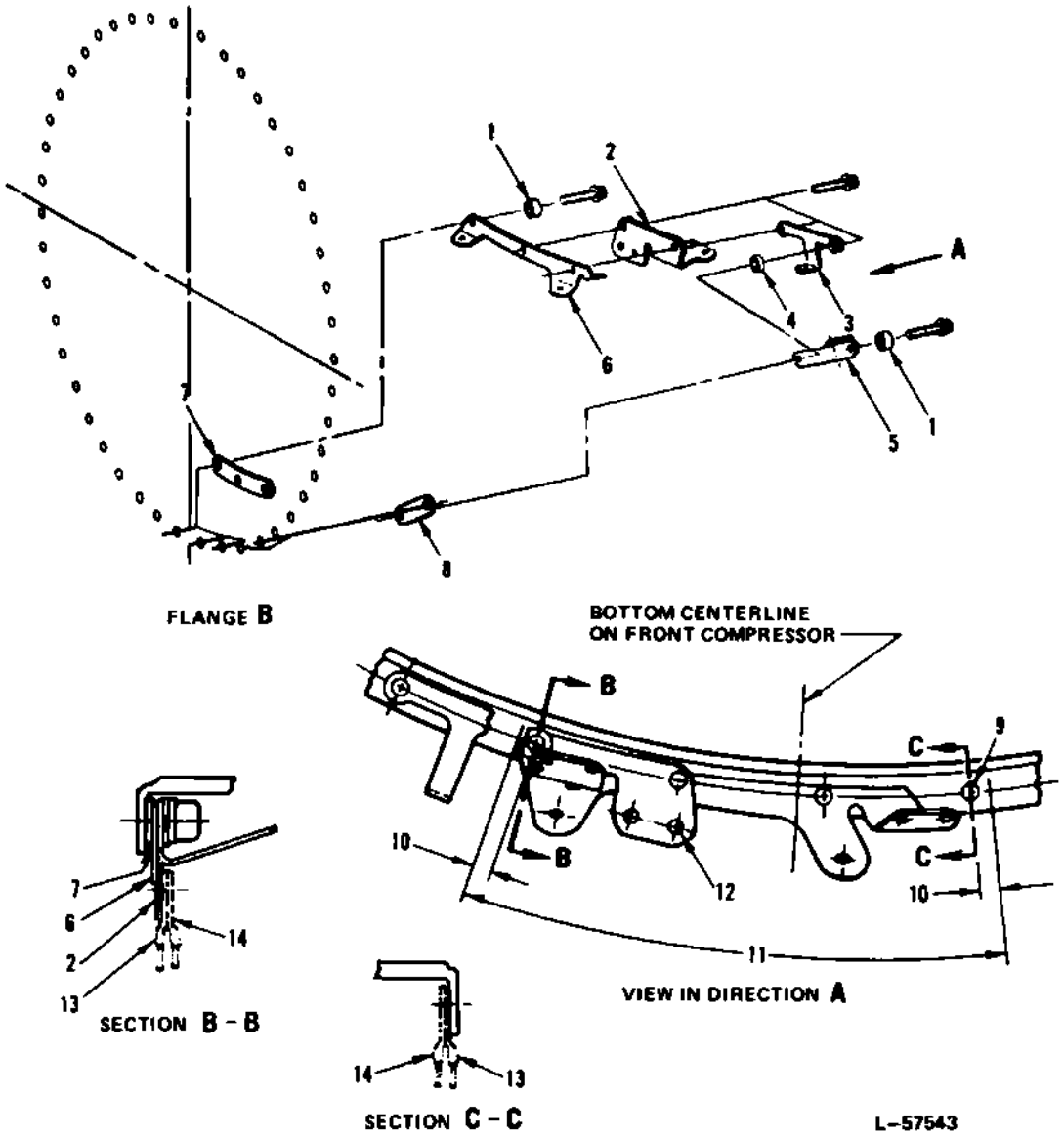
PWA 6587-53	Riveter
PWA 2536	Puller - Front Accessory Drive Support (Replaced By PWA 45222)
PWA 3755	Pump - Hydraulic (Replaced By PWA 29389)
PWA 8050	Wrench - Hydraulic (Replaced by PWA 18201, PWA 18872, Or PWA 33732)
PWA 12015	Drift - No. 1 Balance Bearing No. 1 Seal, Slinger and Bearing Inner Race
PWA 12225	Puller - No. 1 Seal, Slinger and Bearing Inner Race
PWA 12292	Puller - Front Accessory Drive Gearshaft
PWA 12332	Wrench - No. 1 Balance Bearing Retaining Nut (Hand)
PWA 12366	Puller - No. 1 Bearing Outer Race
PWA 12670	Adapter
PWA 14098	Wrench - No. 1 Bearing Inner Race Retaining Nut (Hydraulic)
PWA 18201	Wrench - Hydraulic (Replaced by PWA 18872)
PWA 18872	Wrench - Hydraulic (Replaced By PWA 33732)
PWA 21598	Riveter - No. 1 Bearing Inner Race Retaining Nut Rivet
PWA 29389	Pump - Hydraulic (Replaces PWA 3755)
PWA 32023	Guide
PWA 32024	Wrench - (Hydraulic Adapter)
PWA 32709	Puller - No. 1 Bearing Outer Race
PWA 32766	Rivet - Remover
PWA 32986	Puller - No. 1 Seal, Slinger And Bearing Inner Race
PWA 33229	Shim - Front Compressor Rotor Blade Tip
PWA 33456	Rivet Remover - No. 1 Bearing Outer Race
PWA 33732	Wrench - Hydraulic (Replaces PWA 18872)
PWA 103520	Puller - Front Accessory Drive Support



No. 1 Bearing Area
Figure 201
(Task 72-20-00-990-001)

1. No. 1 Bearing Housing
2. No. 1 Bearing
3. Rear Support
4. Seal Ring
5. Bearing Seal
6. Oil Slinger
7. Front Accessory Drives Support
8. Oil Nozzle

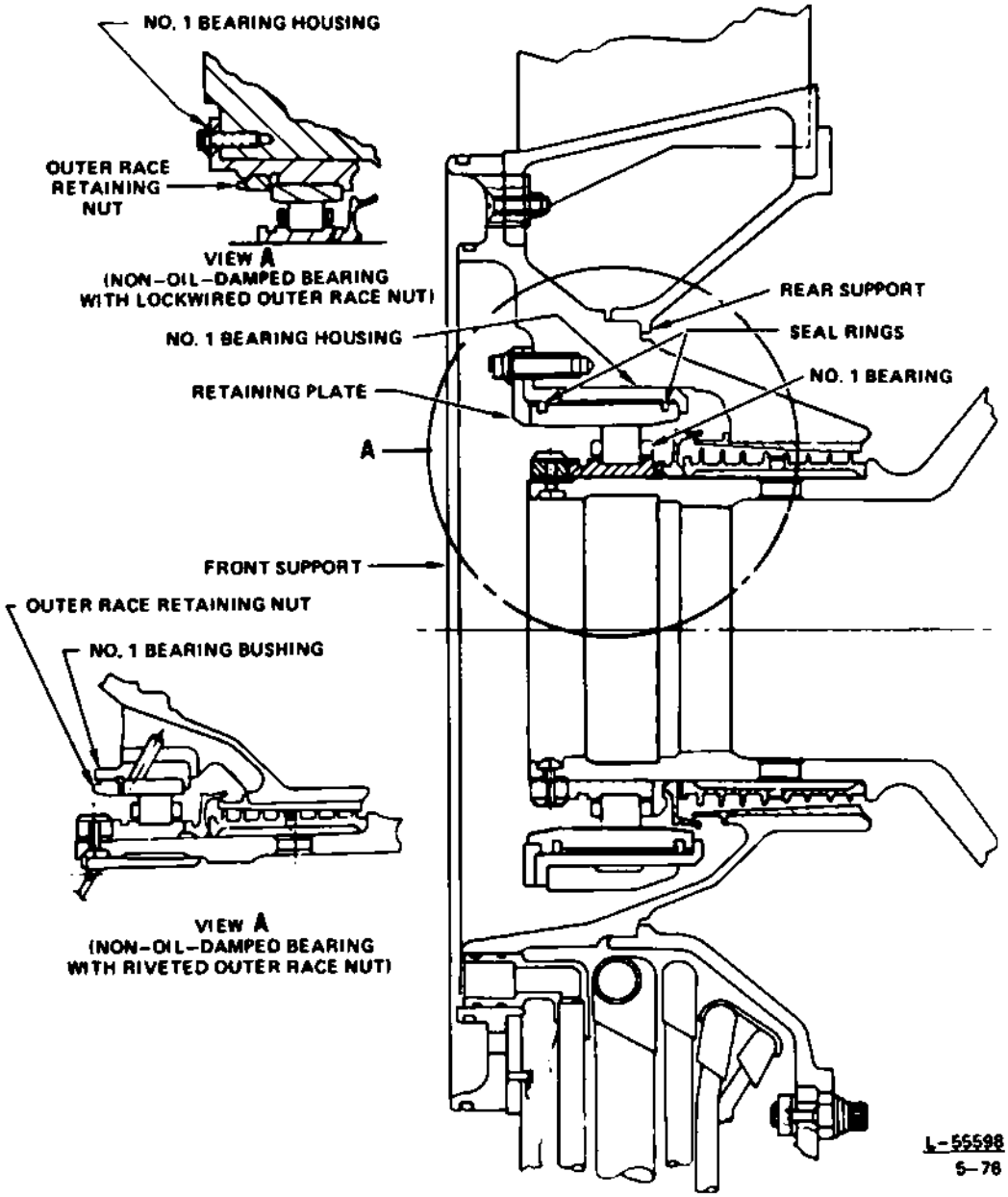
Key to Figure 201



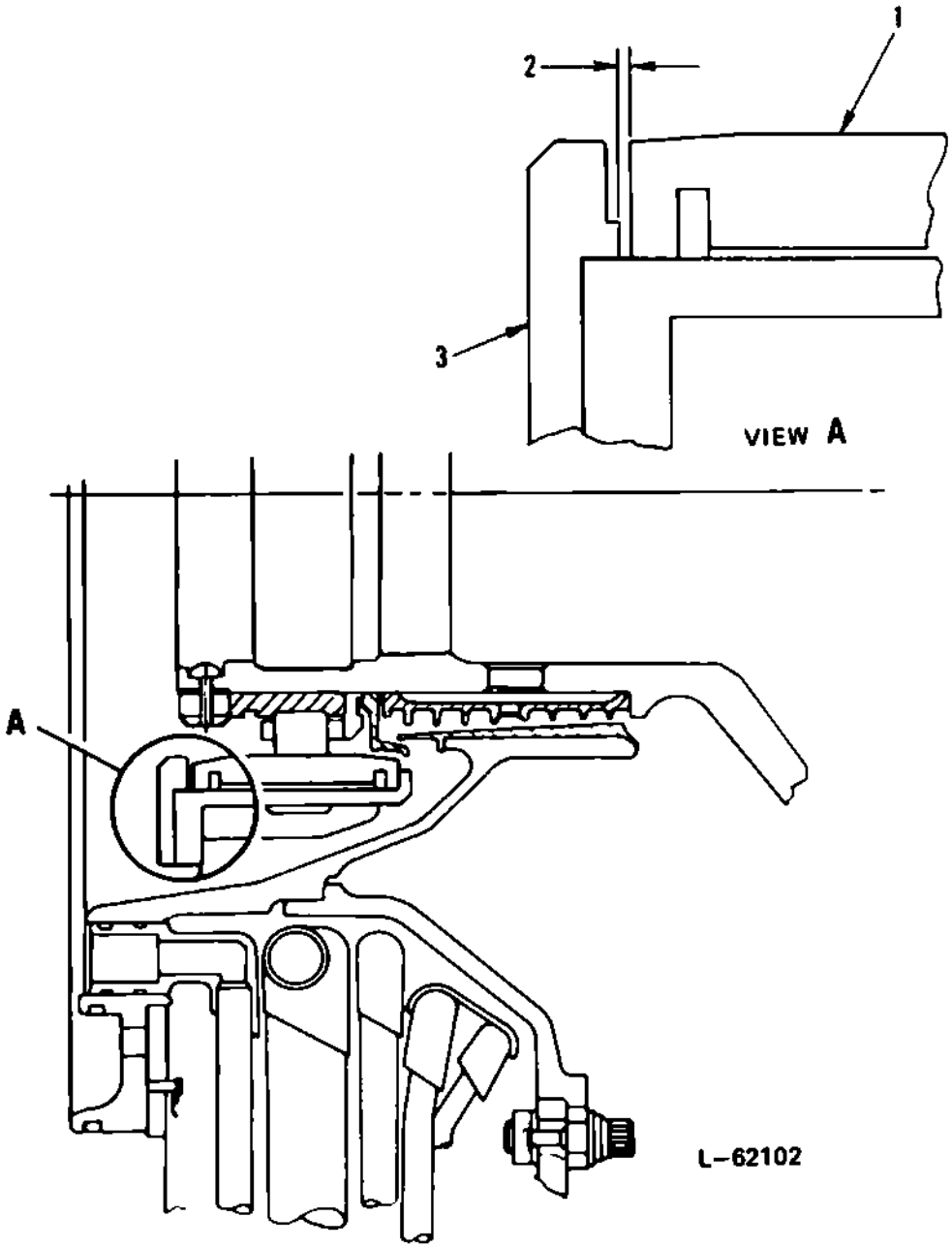
Fire Detection System Bracket
Installation (Boeing 727 Engines)
Figure 202
(Task 72-20-00-990-001)

1. JT8D-17R,-17AR Only: Sleeve Spacer
2. PN 765271 Or 765272 Bracket
3. Angle Bracket
4. JT8D-17R,-17AR Only: Washer
5. Airframe Bracket
6. Airframe Bracket Assembly
7. Plate Spacer
8. Plate Spacer
9. Case Flange Bolthole (For Test Purposes - See Text)
10. 0.375 Inch Minimum
11. Reference Arc (Cleaning Area)
12. Bolthole In Index 2 Bracket (For Text Purposes - See Text)
13. Ohmmeter Sensor Lead
14. Ohmmeter Power Source Lead

Key to Figure 202



No. 1 Bearing Outer Race
Removal/Installation
Figure 203
(Task 72-20-00-990-001)



1. No. 1 Bearing Outer Race
2. Axial Clearance (See Text)
3. No. 1 Bearing Outer Race Retaining Plate

No. 1 Bearing Outer Race
End Clearance Measurement
Figure 204
(Task 72-20-00-990-001)

Task 72-20-00-220-001:

1. Fan Inlet Guide Vane Inspection

A. Minor Damage

(1) Corrosion pitting on vanes and shroud of inlet case is acceptable to 0.020 inch depth except in areas within 1/2 inch of welds joining vanes to shrouds. In this 1/2 inch area, limit is 0.015 inch deep.

(2) Round bottom dents that do not show cracks or tears are acceptable without rework to 1/2 inch maximum diameter and 1/8 inch depth.

(3) Injuries that do not reduce part thickness by more than 0.020 inch, nor show cracks or tears are acceptable without rework, provided injury is of gradual contour shape and not sharp or "V" shaped.

(4) Sharp indentations must be blended to remove surface stress concentrations.

CAUTION: SPECIAL CARE MUST BE USED DURING BLENDING WHEN SUCH INJURIES ARE NEAR INNER OR OUTER FILLET WELDS OF VANES.

(5) Local reduction of vane material after blending must not exceed 0.020 inch depth on leading edge, convex and concave surfaces.

(6) Trailing edge cracks and tears must be removed by blending. Chordal length after blending must not be reduced by more than 3/16 inch. Blended area shall not exceed two inches on any vane.

B. Vane guidelines and continue-in-service limits for cracks (leading edge, radial cracks and vane resistance welds).

(1) When there is more than one crack in a vane or the three separate cracks in the inlet case, remove the inlet case when the aircraft gets to a major maintenance base.

(2) Examine cracks less than one inch long by dye check after 50 cycles. When the dye check inspection confirms that the cracks are not larger, the inspection interval can be increased 50 cycles up to a maximum interval of 600 cycles. When a crack becomes longer but is still less than one inch long, can stop-drill

it. See Chapter/Section 72-23-01, Maintenance Practices-00.

NOTE: Stop-drilled holes in the vanes at 5:30 and 6:00 o'clock positions (from the front) are not permitted because of the internal tubes. Do one inspection after the other on these vanes until the crack is one-inch long, and then remove the inlet case when the aircraft gets to a major maintenance base.

NOTE: Do not stop drill any crack which has turned 90 degrees or is "U" shaped. Examine an inlet case with "U" shaped cracks every day for potential material liberation and remove it as soon as the aircraft can be flown to a major maintenance base.

Task 72-20-00-220-002:

2. Fan Inlet Case Outer Shroud Inspection

A. Refer to Chapter 72-00-00 Fan Inlet Case - Inspection/Check.

FRONT ACCESSORY DRIVES SUPPORT SECTION - DESCRIPTION-00

Task 72-21-00-990-001:

1. Front Accessory Drive Support Description

   A. Mounted on the front of the inlet case, in the center, is the front accessory drive support. This cast magnesium support incorporates a four stud N1 tachometer pad on the upper front face. A pressure oil passage in the support carries oil from the rear of the outer flange into the center, then rearward through the No. 1 bearing oil nozzle. A scavenge oil passage carries oil from a pump boss, on the lower rear face of the support cavity, back toward the outside of the support then to another opening in the rear of the outer flange.

   B. The front accessory drives support has a machined flat on the lower mounting lugs to accommodate a bracket assembly to be used for the N1 tachometer equipment.

   C. The N1 tachometer drive gearshaft and the scavenge pump gearshaft are driven by the front accessory drives gearshaft located in the front hub of the front compressor rotor.

Task 72-21-00-990-002:

2. No. 1 Bearing Oil Scavenge Pump Description

   A. The pump mounts on the pump boss inside the front accessory drives support and is described in the Oil Section - 79-00.

Task 72-21-00-300-001:

1. N1 Tachometer Drive Oil Seal Replacement

See Figure 201.

A. Removal of Seal and Retainer

(1) Remove four nuts and washers and then remove square tachometer drive pad cover or tachometer.

(2) On engines so equipped, remove two screws which secure tachometer drive seal housing to front accessory drive support.

(3) Remove tachometer drive seal retainer from front accessory drives support, using PWA 7146 Puller.

(4) Remove packing from OD of retainer.

B. Seal Replacement

(1) Remove seal from retainer.

(2) Using PWA 12547 Drift and PWA 12540 Base install new seal in retainer as follows:

NOTE: Install seal so lip will face into accessory drives support.

NOTE: If tools are not readily available, heat aluminum housing to 175° - 212°F (79° - 100°C), lubricate seal OD and hand press seal into retainer.

(a) Position oil seal retainer on base.

(b) Place seal on drift, making sure driving face of drift bottoms inside of seal.

(c) Position drift and seal on base (pilot of drift piloting on base) and drift seal in place, coil spring up.

C. Installation Of Seal And Retainer

R (1) Install a new packing, lubricated with a thin layer
R of PWA 36500 lubricant, in the OD groove of the seal
R retainer.

R NOTE: Refer to 70-30-00, Standard Practices-01,
R lubricant P06-053.

(2) Using PWA 14047 Guide, install seal retainer into tachometer drive opening in front accessory drives support.

NOTE: Lubricate seal ID with engine oil prior to installing retainer and seal assembly over tachometer shaft.

(3) On engines so equipped, secure tachometer drive seal retainer to front accessory drives support using two countersunk screws.

(4) Using new gasket, reinstall tachometer drive pad cover or tachometer and secure using four washers and nuts.

Task 72-21-00-300-002:

2. Removal/Installation of Front Accessory Drives Support

See Figure 201.

A. Removal

(1) Remove bolts securing front accessory drive support to inlet case.

(2) Using PWA 45222 (formerly PWA 2536) Puller, remove housing assembly from inlet case.

NOTE: Transfer tubes may remain in position or become disengaged when housing assembly is removed.

(3) Place support assembly (front face down) on bench.

(4) Remove transfer tubes from housing.

B. Installation

(1) Install new packings, lubricated with PWA 36500 Assembly Fluid, on all transfer tubes.

R NOTE: Refer to 70-30-00, Standard Practices-01,
R lubricant P06-053.

(2) Install transfer tubes on front face of No. 1 bearing front support.

(3) Install new packing lubricated with PWA 36500 Assembly Fluid, on inner groove on front of No. 1 bearing front support.

(4) Reinstall support on inlet case.

(5) Install N1 tachometer bracket and secure the support to inlet case with the washers and bolts.

(6) Tighten the bolts to the recommended torque.

Task 72-21-00-300-003:

3. Removal/Installation of the No. 1 Bearing Oil Scavenge Pump

See Figure 201.

A. Removal

(1) Remove nuts securing the pump to housing.

(2) Remove nuts on two studs holding pump and shield.

(3) Remove washers and nuts on two studs holding pump nearest center of housing.

(4) Remove pump and shield.

B. Installation

(1) Position front accessory drive housing so that studded pad inside of housing is next to mechanic.

(2) Position No. 1 bearing scavenge pump shield over pump drive gear to pump body, aligning stud holes. Position pump assembly and shield over studs to pad in housing.

(3) Install washers and nuts on two pump holding studs nearest center of housing.

(4) Install nuts on two studs holding pump and shield.

(5) Tighten and lockwire four nuts.

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Task 72-21-00-300-004:

4. Removal/Installation of No. 1 Bearing Oil Nozzle

A. Removal

(1) Unscrew and remove oil nozzle from inner surface of front accessory support assembly.

B. Installation

(1) Install oil nozzle in front accessory support assembly.

(2) Torque nozzle to Removal/Installation, "Fits and Clearances," Reference 361 (Reference 102 for JT8D-15,-15A, -17,-17A,-17R and -17AR)

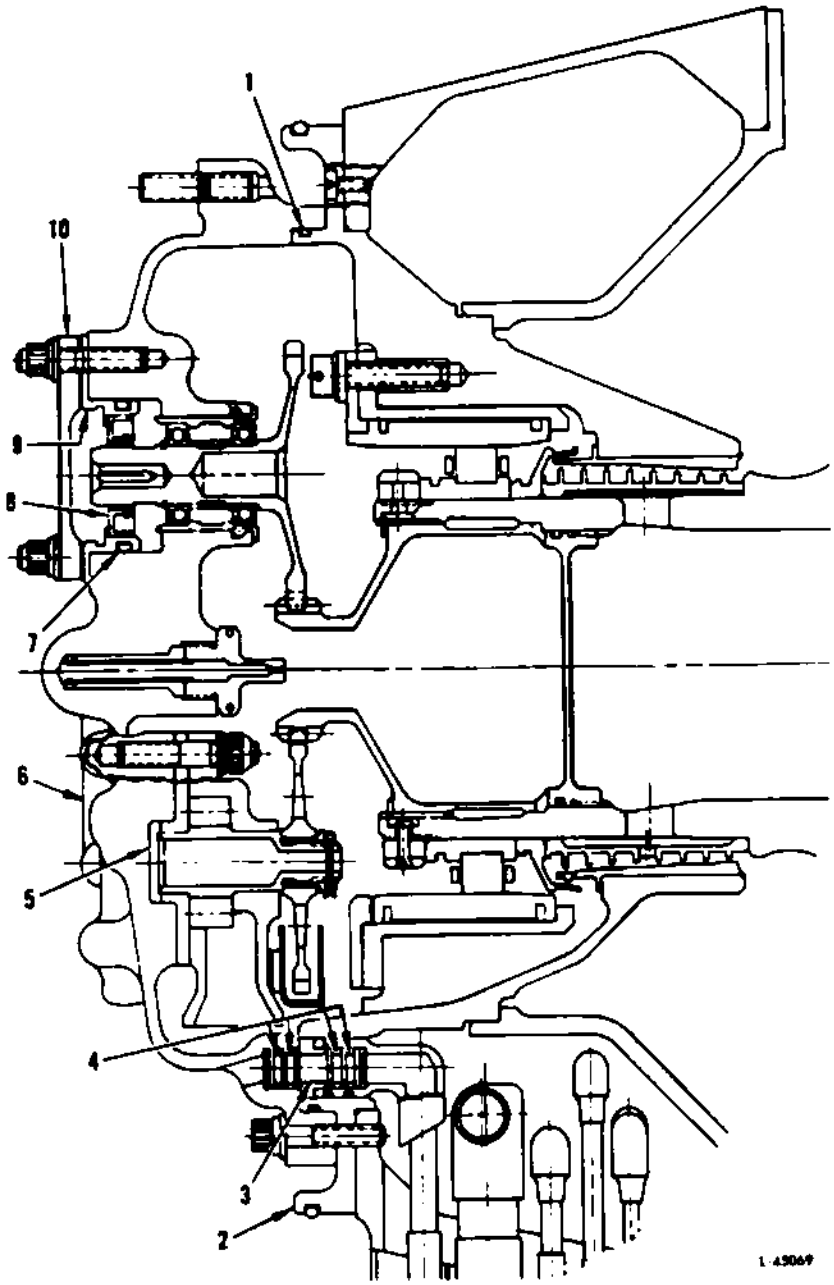
(3) Lockwire nozzle to wall of front accessory support assembly.

Task 72-21-00-300-005:

5. Numerical Tool List

A. Numerical Tool List

PWA 2536	Puller - Front Accessory Support (Replaced By PWA 45222)
PWA 6841	Drift - N1 Tachometer Drive Seal (Superseded by PWA 12547)
PWA 7146	Puller - Tachometer Drive Seal Housing
PWA 12540	Base - N1 Tachometer Shaft Seal Housing
PWA 12547	Drift - N1 Tachometer Drive Seal
PWA 14047	Guide - Tachometer Drive Seal
PWA 45222	Puller - Front Accessory Support (Replaces PWA 2536)



Front Accessory Drives Support
Figure 201
(Task 72-21-00-300-005)

1. Packing
2. No. 1 Bearing Front Support
3. Transfer Tube (Typical)
4. Packings (Four Required On Each Transfer Tube).
5. No. 1 Bearing Oil Scavenge Pump
6. Front Accessory Drives Support
7. Packing
8. N1 Tachometer Drive Oil Seal
9. N1 Tachometer Drive Oil Seal Retainer
10. N1 Tachometer Drive Pad Cover

Key to Figure 201

Task 72-21-00-990-003:

1. Front Accessory Drives Support - Fits and Clearances

A. JT8D-1,-1A,-1B,-7,-7A,-7B,-9,-9A
See Figure 401.

REF. NO.	DESCRIPTION	REF. DIMENSIONS MIN	REF. DIMENSIONS MAX	LIMITS MIN	LIMITS MAX	REPLACE
1	Oil Scavenge Pump Cover	.936	.937			
	Front Accessory Drive Housing	.937	.939	.000	.003	.005
2	Oil Scavenge Pump Drive Gearshaft	.685	.686			
	Oil Scavenge Pump Cover	.687	.688	.001	.003	.004
3	Oil Scavenge Pump Gears	1.499	1.501			
	Oil Scavenge Pump Housing	1.504	1.506	.003	.007	.008
4	Oil Scavenge Pump Drive Gearshaft	.685	.686			
	Oil Scavenge Pump Housing	.687	.688	.001	.003	.004
5	Oil Scavenge Pump Drive Gearshaft	.0485	.0495			
	Spur Gear (Splines)	.0490	.0500	.0005T	.0015	.0025
6	Oil Scavenge Pump Drive Gears	.4953	.4960			
	Oil Pump Housing & Cover (End Clearance)	.498	.500	.002	.0047	.0047
7	Oil Scavenge Pump Idler Shaft	.6015	.6020			
	Cover	.603	.604	.001	.0025	.0035

FRONT ACCESSORY DRIVES SUPPORT SECTION - INSPECTION/CHECK-00

REF. NO.	DESCRIPTION	REF. DIMENSIONS MIN	REF. DIMENSIONS MAX	LIMITS MIN	LIMITS MAX	REPLACE
8	Oil Scavenge Pump Idler Shaft	.6015	.6020			
	Idler Pinion Gear	.603	.604	.001	.0025	.0035
9	Oil Scavenge Pump Idler Shaft	.6015	.6020			
	Oil Scavenge Pump Housing	.600	.601	.0005T	.002T	*
14	PN 515433 Seal Tachometer Drive Shaftgear	1.381	1.385	.005T	.011T	.005T
	PN 515432 Seal Tachometer Drive Shaftgear	1.378	1.382	.002T	.008T	.002T
	Housing Tachometer Drive Shaftgears Seal	1.374	1.376			
15	Housing Tachometer Drive Shaftgear Seal	1.699	1.700			
	Housing Front Accessory Drive	1.700	1.701	.000	.002	.003
16	Bearing (OD) - PN 211628, 211629 Housing Assy. Front Acc. Drive Bushing	1.1807	1.1811			
		1.1811	1.1817	.000	.001	.0012
	Bearing (OD) - PN 380006, 457526 Housing Assy. Front Acc. Drive Bushing	1.1809	1.1811			
		1.1811	1.1817	.000	.0008	.001

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FRONT ACCESSORY DRIVES SUPPORT SECTION - INSPECTION/CHECK-00

REF. NO.	DESCRIPTION	REF. DIMENSIONS MIN	REF. DIMENSIONS MAX	LIMITS MIN	LIMITS MAX	REPLACE
17	Tachometer Drive Gearshaft	.6692	.6695			
	Bearing (ID) - PN 211628, 211629	.6690	.6693	.0005T	.0001	.0001
	Bearing (ID) - PN 380006, 457526	.6691	.6693	.0004T	.0001	.0001
18	Tachometer Drive Gearshaft	.6692	.6695			
	Spacer	.6700	.6760	.0005	.0068	.009
21	Compressor Front Bearing Support Housing Accessory Drive Front	9.669	9.671			
		9.669	9.671	.002T	.002	.003
22	Front Bearing Support Compressor Inlet Case Assembly	9.580	9.581			
		9.579	9.581	.002T	.001	.002
23	Compressor Front Bearing Support (Other Than Below) Rear Support (Other Than Below)	7.700	7.702			
		7.698	7.700	.000	.004T	.002
	Compressor Front Bearing Support PN 765471 Rear Support PN 765469	7.261	7.263			
		7.259	7.261	.000	.004T	.002
24	Compressor Front Bearing Rear Support Inlet Case Assembly - Of	11.680	11.681			
		11.6795	11.6815	.0015T	.0015	.002

FRONT ACCESSORY DRIVES SUPPORT SECTION - INSPECTION/CHECK-00

REF. NO.	DESCRIPTION	REF. DIMENSIONS MIN	REF. DIMENSIONS MAX	LIMITS MIN	LIMITS MAX	LIMITS REPLACE
25	Non-Oil-Damped Bearing Type: Compressor Front Bearing Seal Support Assembly - (Ring) (Diameters Are Listed Front to Rear)					
	Seal	4.488	4.490			
	Ring	4.499	4.504	.009	.016	.018
	Seal	4.468	4.470			
	Ring	4.479	4.484	.009	.016	.018
	Seal	4.448	4.450			
	Ring	4.459	4.464	.009	.016	.018
	Seal	4.428	4.430			
	Ring	4.439	4.444	.009	.016	.018
	Seal	4.408	4.410			
	Ring	4.419	4.424	.009	.016	.018
	Seal	4.388	4.390			
	Ring	4.399	4.404	.009	.016	.018
	Seal	4.368	4.370			
	Ring	4.379	4.384	.009	.016	.018
	Seal	4.348	4.350			
	Ring	4.359	4.364	.009	.016	.018
	Oil-Damped Bearing Type: Compressor Front Bearing Seal Support Assembly - Ring (Diameters Are Listed Front to Rear)					
	Seal	4.488	4.490			
	Ring	4.504	4.509	.014	.021	.023
	Seal	4.468	4.470			
	Ring	4.484	4.489	.014	.021	.023
	Seal	4.448	4.450			
	Ring	4.464	4.469	.014	.021	.023
	Seal	4.428	4.430			
	Ring	4.444	4.449	.014	.021	.023
	Seal	4.408	4.410			
	Ring	4.424	4.429	.014	.021	.023
	Seal	4.388	4.390			

FRONT ACCESSORY DRIVES SUPPORT SECTION - INSPECTION/CHECK-00

REF. NO.	DESCRIPTION	REF. DIMENSIONS MIN	REF. DIMENSIONS MAX	LIMITS MIN	LIMITS MAX	REPLACE
	Ring	4.404	4.409	.014	.021	.023
	Seal	4.368	4.370			
	Ring	4.384	4.389	.014	.021	.023
	Seal	4.348	4.350			
	Ring	4.364	4.369	.014	.021	.023
26	Front Compressor Rotor Front Hub Bearing Seal (Rear End)	3.7595 3.7570	3.7600 3.7585	 .0010T	 .0030T	 .0005T
27	Front Compressor Rotor Front Hub Bearing Seal (Front End) Bearing Seal (Front End) (PN 452308A & Subsequent)	3.7495 3.7490 3.7485	3.7500 3.7505 3.7500	 .0010T .0015T	 .0010 .0005	 .0010 .0005
28	Front Compressor Rotor Front Hub Bearing Oil Slinger	3.7495 3.7490	3.7500 3.7505	 .0010T	 .0010	 .002
29	Front Compressor Rotor Front Bearing (ID)	3.7422 3.7399	3.7429 3.7402	 .0020T	 .0030T	 .002T
30	Non-Oil-Damped Bearing: Bearing (OD) Compressor Front Bearing Support Assembly	5.3146 5.3150	5.3150 5.3157	 .0000	 .0011	 .0011
	Oil-Damped Bearing: Bearing (OD) Compressor Front Bearing Support Assembly	5.5566 5.5647	5.5580 5.5659	 .0067	 .0093	 .0093

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FRONT ACCESSORY DRIVES SUPPORT SECTION - INSPECTION/CHECK-00

	REF. NO.	DESCRIPTION	REF. DIMENSIONS MIN	REF. DIMENSIONS MAX	LIMITS MIN	LIMITS MAX	REPLACE
	31	Accessory Drive Gearshaft (Spline)	.0481	.0491			
		Front Compressor Rotor Hub (Spline)	.0491	.0511	.0000	.0030	.004
	32	Accessory Drive Gearshaft	3.182	3.184			
		Front Hub	3.186	3.188	.002	.006	.008
	33	Compressor Rotor Plug	3.178	3.182			
		Front Hub	3.186	3.188	.004	.010	.013
	34	Compressor Rotor Plug	3.010	3.014			
		Front Hub (Seal Lands)	3.018	3.020	.004	.010	.013
	51	Front Compressor Front Case Inlet Case Assembly - Of	40.753	40.759			
			40.747	40.753	.000	.012T	.002
	77	No. 1 Bearing Seal Ring Gap					
R		NOTE: Refer to 72-00-00, Inspection/ Check-02, Reference 8.					
	78	No. 1 Bearing Outer Race Seal Ring Side Clearance					
R		NOTE: Refer to 72-00-00, Inspection/					

	REF. NO.	DESCRIPTION	REF. DIMENSIONS MIN	REF. DIMENSIONS MAX	LIMITS MIN	LIMITS MAX	REPLACE
	(CONTINUED)						
R		Check-02, Reference 6.					
	200	Oil Scavenge Pump Drive Gearshaft Gear Pinion Idler (Backlash)			.0045	.0195	
	211	Axial Fit - No. 1 Bearing to Plate -					
R		Retaining					
R		NOTE: Refer to 72-00-00, Inspec-					
R		tion/ Check-02, Reference					
R		96.					
	212	Side Clearance Plate - Retaining Bearing					
R		No. 1					
R		Housing -					
R		No. 1 Bearing					
R		NOTE: Refer to 72-00-00, Inspec-					
R		tion/ Check-02, Reference					
R		97.					

B. Special Torque Limits and Spring Loads

REF. NO.	DESCRIPTION	LIMITS MIN	MAX	REPLACE
350	Oil Scavenge Pump Drivegear Nut	150	250	
351	Front Compressor Front Bearing Outer Race Retaining Nut 1) Tighten nut to 2000 lb-in. 2) Mark location of nut with reference to mating part. 3) Turn nut through angle of 20 degrees minimum to 27 degrees maximum. 4) Loosen nut to 0 lb-in. and repeat step 1). 5) If nut mark is in line with or beyond mating part reference mark within .100 inch max., apply final angle of turn per step 3). 6) If marks are not within limits, repeat steps 2), 3), and 4) in order, until marks are within limits. Then perform step 5).			
352	Front Compressor Front Bearing Inner Race Retaining Nut 1) Tighten nut to 2000 lb. in. 2) Mark location of nut with reference to mating part. 3) Turn nut thru angle of 14 degrees min to 17 degrees max. 4) Loosen nut to 0 lb - in. and repeat step 1). 5) If nut mark is in line with or beyond mating part refer- ence mark within .050 inch max., apply final angle of turn per			

R
R

REF. NO.	DESCRIPTION	LIMITS MIN	LIMITS MAX	LIMITS REPLACE
(CONTINUED)	step 3).			
	6) If marks are not within limits, repeat steps 2), 3) and 4) in order, until marks are within limits. Then perform step 5).			
361	No. 1 Bearing Oil Nozzle (50 lb - in. Max. after Mating Faces Contact).			

C. JT8D-11
See Figure 402.

REF NO.	DESCRIPTION	REF. DIMENSIONS MIN	REF. DIMENSIONS MAX	LIMITS MIN	LIMITS MAX	LIMITS REPLACE
1	Oil Scavenge Pump Cover	.936	.937			
	Front Accessory Drive Housing	.937	.939	.000	.003	
2	Oil Suction Pump Drive Gearshaft	.685	.686			
	Oil Scavenge Pump Cover	.687	.688	.001	.003	
3	Oil Suction Pump Gears	1.499	1.501			
	Oil Scavenge Pump Housing	1.504	1.506	.003	.007	
4	Oil Suction Pump Drive Gearshaft	.685	.686			
	Oil Scavenge Pump Housing	.687	.688	.001	.003	
5	Oil Suction Pump Drive Gearshaft Gear - Spur (Splines)	.0485 .0490	.0495 .0500	.0005T	.0015	

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R

FRONT ACCESSORY DRIVES SUPPORT SECTION - INSPECTION/CHECK-00

REF NO.		DESCRIPTION	REF. DIMENSIONS MIN	REF. DIMENSIONS MAX	LIMITS MIN	LIMITS MAX	REPLACE
6		Oil Suction Pump Drive Gears	.4953	.4960			
		Oil Pump Housing & Cover (End Clearance)	.498	.500	.002	.0047	
7		Oil Suction Pump Idler Shaft	.6015	.6020			
		Cover	.603	.604	.001	.0025	
8		Oil Suction Pump Idler Shaft	.6015	.6020			
		Idler Pinion Gear	.603	.604	.001	.0025	
9	F	Oil Scavenge Pump Idler Shaft	.6015	.6020			
		Oil Scavenge Pump Housing	.600	.601	.0005T	.002T	*
14	C	515433 Seal Tachometer Drive Shaftgear	1.381	1.385	.005T	.011T	.005T
		515432 Seal Tachometer Drive Shaftgear	1.378	1.382	.002T	.008T	.002T
		Housing Tachometer Drive Shaftgears Seal	1.374	1.376			
15	D	Housing Tach. Drive Shaftgear Seal	1.699	1.700			
		Housing Front Accessory Drive	1.700	1.701	.000	.002	.003

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EFF: -ALL

FRONT ACCESSORY DRIVES SUPPORT SECTION - INSPECTION/CHECK-00

REF NO.		DESCRIPTION	REF. DIMENSIONS MIN	REF. DIMENSIONS MAX	LIMITS MIN	LIMITS MAX	LIMITS REPLACE
16	B	Bearing (OD) Housing Assembly Front Accy.	1.1809	1.1811			
		Drive Bushing	1.1811	1.1817	.000	.0008	.001
17	B	Tachometer Drive Gearshaft	.6692	.6695			
		Bearing (ID)	.6691	.6693	.0004T	.0001	.0001
18	E	Tachometer Drive Gearshaft	.6692	.6695			
		Spacer	.6700	.6760	.0005	.0068	.009
21	D	Compressor Front Bearing Support Housing Accessory	9.669	9.671			
		Drive Front	9.669	9.671	.002T	.002	.003
22		Front Bearing Support Compressor Inlet	9.580	9.581			
		Case Assembly	9.579	9.581	.002T	.001	.002
23		Compressor Front Bearing Support (Other than Below)	7.700	7.702			
		Rear Support (Other Than Below)	7.698	7.700	.000	.004T	.002
		Compressor Front Bearing Support PN 765471	7.261	7.263			
		Rear Support PN 765469	7.259	7.261	.000	.004T	.002

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EFF: -ALL

REF NO.	DESCRIPTION	REF. DIMENSIONS MIN	REF. DIMENSIONS MAX	LIMITS MIN	LIMITS MAX	LIMITS REPLACE
24	Compressor Front Bearing Rear Support Inlet Case Assembly - Of	11.680	11.681			
		11.6795	11.6815	.0015T	.0015	.002
25	Non-Oil-Damped Bearing Area: Compressor Front Bearing Seal Support Assembly - (Ring) (Diameters Are Listed Front to Rear)					
	Seal	4.488	4.490			
	Ring	4.499	4.504	.009	.016	.018
	Seal	4.468	4.470			
	Ring	4.479	4.484	.009	.016	.018
	Seal	4.448	4.450			
	Ring	4.459	4.464	.009	.016	.018
	Seal	4.428	4.430			
	Ring	4.439	4.444	.009	.016	.018
	Seal	4.408	4.410			
	Ring	4.419	4.424	.009	.016	.018
	Seal	4.388	4.390			
	Ring	4.399	4.404	.009	.016	.018
	Seal	4.368	4.370			
	Ring	4.379	4.384	.009	.016	.018
	Seal	4.348	4.350			
	Ring	4.359	4.364	.009	.016	.018
	Oil-Damped Bearing Area: Compressor Front Bearing Seal Support Assembly - Ring (Diameters are listed from front to rear)					
	Seal	4.488	4.490			
	Ring	4.504	4.509	.014	.021	.023
	Seal	4.468	4.470			
	Ring	4.484	4.489	.014	.021	.023
	Seal	4.448	4.450			

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R

FRONT ACCESSORY DRIVES SUPPORT SECTION - INSPECTION/CHECK-00

REF NO.	DESCRIPTION	REF. DIMENSIONS MIN	REF. DIMENSIONS MAX	LIMITS MIN	LIMITS MAX	LIMITS REPLACE
(CONTINUED)						
	Ring	4.464	4.469	.014	.021	.023
	Seal	4.428	4.430			
	Ring	4.444	4.449	.014	.021	.023
	Seal	4.408	4.410			
	Ring	4.424	4.429	.014	.021	.023
	Seal	4.388	4.390			
	Ring	4.404	4.409	.014	.021	.023
	Seal	4.368	4.370			
	Ring	4.384	4.389	.014	.021	.023
	Seal	4.348	4.350			
	Ring	4.364	4.369	.014	.021	.023
26	Front Compressor Rotor Front Hub Bearing Seal (Rear End)	3.7595	3.7600	.0010T	.0030T	.0005T
		3.7570	3.7585			
27	Front Compressor Rotor Front Hub Bearing Seal (Front End)	3.7495	3.7500	.0015T	.005	.0005
		3.7485	3.7500			
28	Front Compressor Rotor Front Hub Bearing Oil Slinger	3.7495	3.7500	.0010T	.0010	.002
		3.7490	3.7505			
29	Front Compressor Rotor Front Hub Bearing (ID)	3.7422	3.7429	.0020T	.0030T	.002T
		3.7399	3.7402			
30	Non-Oil-Damped Bearing: Bearing (OD) Compressor Front Bearing Support Assy.	5.3146	5.3150	.0000	.0011	.0011
		5.3150	5.3157			
	Oil-Damped Bearing: Bearing (OD) Compressor	5.5566	5.5580			

R
R

	REF NO.	DESCRIPTION	REF. DIMENSIONS MIN	REF. DIMENSIONS MAX	LIMITS MIN	LIMITS MAX	REPLACE
		(CONTINUED)					
		Front Bearing Support Assembly	5.5647	5.5659	.0067	.0093	.0093
	31	Accessory Drive Gearshaft (Spline)	.0481	.0491			
		Front Compressor Rotor Front Hub (Spline)	.0491	.0511	.0000	.0030	.004
	32	Accessory Drive Gearshaft Front Hub	3.182 3.186	3.184 3.188	 .002	 .006	 .008
	33	Compressor Rotor Plug Front Hub	3.178 3.186	3.182 3.188	 .004	 .010	 .013
	34	Compressor Rotor Plug Front Hub (Seal Lands)	3.010 3.019	3.014 3.029	 .004	 .010	 .013
	51	Front Compressor Front Case Inlet Case Assembly - Of	40.753 40.747	40.759 40.753	 .000	 .012T	 .002
	77	No. 1 Bearing Outer Race Seal					
R		Ring Gap					
R		NOTE: Refer to 72-00-00, Inspec- tion/					

	REF NO.	DESCRIPTION	REF. DIMENSIONS MIN	REF. DIMENSIONS MAX	LIMITS MIN	LIMITS MAX	LIMITS REPLACE
	(CONTINUED)						
R		Check-02,					
R		Reference					
R		8.					
	78	No. 1 Bearing					
R		Outer Race					
R		Seal Ring					
R		(Side					
R		Clearance)					
R		NOTE: Refer to					
R		72-00-00,					
R		Inspec-					
R		tion/					
R		Check-02,					
R		Reference					
R		6.					
	162	Axial Fit - No.					
		1 Bearing to					
		Plate -					
R		Retaining					
R		NOTE: Refer to					
R		72-00-00,					
R		Inspec-					
R		tion/					
R		Check-02,					
R		Reference					
R		96.					
	163	Side Clearance					
		Plate -					
		Retaining					
R		Bearing No. 1					
R		Housing -					
R		No. 1 Bearing					
R		NOTE: Refer to					
R		72-00-00,					
R		Inspec-					
R		tion/					
R		Check-02,					
R		Reference					
R		97.					

REF NO.	DESCRIPTION	REF. DIMENSIONS MIN	REF. DIMENSIONS MAX	LIMITS MIN	LIMITS MAX	LIMITS REPLACE
200	Oil Scavenge Pump Drive Gearshaft Gear Pinion Idler (Backlash)			.0045	.0195	

D. Special Torque Limits and Spring Loads

REF. NO.	DESCRIPTION	LIMITS MIN	LIMITS MAX	LIMITS REPLACE
350	Oil Scavenge Pump Drivegear Nut	150	250	

351 Front Compressor Front Bearing Outer Race Retaining Nut

1. Tighten nut to 2000 lb.-in.
2. Mark location of nut with reference to mating part.
3. Turn nut through angle of 20 degrees minimum to 27 degrees maximum.
4. Loosen nut to zero lb - in. and repeat step 1.
5. If nut mark is in line with or beyond mating part reference mark within .100 inch max., apply final angle of turn per step 3.
6. If marks are not within limits, repeat steps 2, 3 and 4 in order, until marks are within limits. Then perform step 5.

352 Front Compressor Front Bearing Inner Race Retaining Nut

1. Tighten nut to 2000 lb - in.
2. Mark location of nut with reference to mating part.

R
R

REF. NO.	DESCRIPTION	LIMITS MIN	MAX	REPLACE

(CONTINUED)

3. Turn nut through angle of 14° min. to 17° max.

4. Loosen nut to zero lb - in. and repeat step 1.

5. If nut mark is in line with or beyond mating part ref- erence mark within .050 inch max., apply final angle of turn per step 3.

6. If marks are not within limits, repeat steps 2, 3 and 4 in order, until marks are within limits. Then perform step 5.

361 No. 1 Bearing Oil Nozzle (50 lb. in. Max. after Mating Faces Contact)

E. JT8D-15,-15A,-17,-17A,-17R,-17AR
See Figure 403.

REF NO.	DESCRIPTION	REF. DIMENSIONS MIN	MAX	LIMITS MIN	MAX	REPLACE
1	No. 1 Bearing Scavenge Pump	.936	.937			
	Support-Front Accessory	.937	.939	.000	.003	.005
2	Gear-Spur, Drive Housing-No. 1 Bearing Scavenge Pump	.685	.686			
		.687	.688	.001	.003	.004
3	Gear-Spur, Drive Housing-No. 1 Bearing Scavenge Pump	1.499	1.501			
		1.504	1.506	.003	.007	.008

R
R

FRONT ACCESSORY DRIVES SUPPORT SECTION - INSPECTION/CHECK-00

REF NO.	DESCRIPTION	REF. DIMENSIONS MIN	REF. DIMENSIONS MAX	LIMITS MIN	LIMITS MAX	LIMITS REPLACE
4	Gear-Spur, Drive	.685	.686			
	Housing-No. 1 Bearing Scavenge Pump	.687	.688	.001	.003	.004
5	Gear-Spur, Drive	.0485	.0495			
	Gear-Spur, Front Accessory	.0490	.0500	.0005T	.0015	.0025
6	Gear-Spur, Drive	.4953	.4960			
	Housing-No. 1 Bearing Scavenge Pump	.498	.500	.002	.0047	.0047
7	Shaft-Scavenge Pump, Idler	.6015	.6020			
	Cover-No. 1 Bearing Scavenge Pump	.603	.604	.001	.0025	.0035
8	Shaft-Scavenge Pump, Idler	.6015	.6020			
	Gear-Spur, Idler	.603	.604	.001	.0025	.0035
9	Shaft-Scavenge Pump, Idler	.6015	.6020			
	Housing-No. 1 Bearing Scavenge Pump	.600	.601	.0005T	.002T	
10	Gear-Spur, Idler	1.499	1.501			
	Housing-No. 1 Bearing Scavenge Pump	1.504	1.506	.003	.007	.008
11	Housing-No. 1 Bearing, Assy of	9.669	9.671			
	Support-Front Accessory	9.669	9.671	.002T	.002	.003

R
R

EFF: -ALL

FRONT ACCESSORY DRIVES SUPPORT SECTION - INSPECTION/CHECK-00

REF NO.		DESCRIPTION	REF. DIMENSIONS MIN	REF. DIMENSIONS MAX	LIMITS MIN	LIMITS MAX	LIMITS REPLACE
12	D	Housing-No. 1 Bearing, Assy of Case-Fan Inlet, Assy of	9.580 9.579	9.581 9.581	 .002T	 .001	 .002
13		Compressor Front Bearing Support (Other Than Below) Rear Support (Other Than Below)	7.700 7.698	7.702 7.700	 .000	 .004T	 .002
		Compressor Front Bearing Support PN 765471 Rear Support PN 765469	7.261 7.259	7.263 7.261	 .000	 .004T	 .002
14		515433 Seal-Tachometer Drive Shaftgear Housing-Tach Drive Shaftgears Seal	1.381 1.374	1.385 1.376	 .005T	 .011T	 .005T
		515432 Seal-Tachometer Drive Shaftgear Housing-Tach Drive Shaftgears Seal	1.378 1.374	1.382 1.376	 .002T	 .008T	 .002T
15		Retainer-OSE, Tachometer Drive Support-Front Accessory	1.699 1.700	1.700 1.701	 .000	 .002	 .003
16		Bearing-(O.D.) Support Assy-Front Accessory	1.1809 1.1811	1.1811 1.1817	 .000	 .0008	 .001

R
R

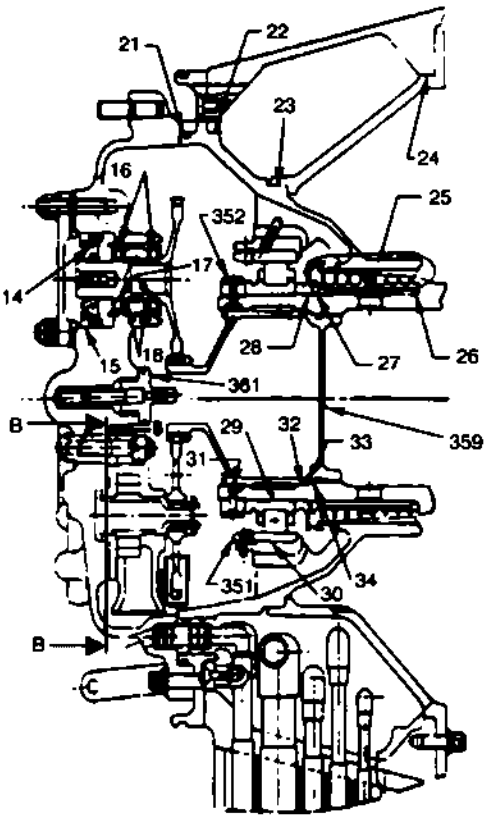
EFF: -ALL

REF NO.	DESCRIPTION	REF. DIMENSIONS MIN	REF. DIMENSIONS MAX	LIMITS MIN	LIMITS MAX	LIMITS REPLACE
17	Gearshaft-Spur,					
	Tachometer Drive Bearing-(I.D.)	.6692 .6691	.6695 .6693	 .0004T	 .0001	 .0001
18	Gearshaft-Spur,					
	Tachometer Drive Spacer-Sleeve	.6692 .6700	.6695 .6760	 .0005	 .0068	 .009
19	Support-No. 1 Bearing Case-Fan Inlet, Assy of	11.680 11.6795	11.681 11.6815	 .0015T	 .0015	 .002
20	Gear-Spur, Idler Housing-No. 1 Bearing Scavenge Pump	.4953 .498	.4960 .500	 .002	 .0047	 .0047
21	Backlash Gear-Spur, Drive Gear-Spur, Idler			.0045	.0195	

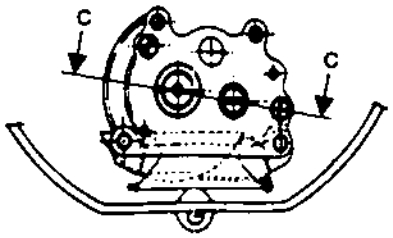
F. Special Torque Limits

REF. NO.	DESCRIPTION	LIMITS MIN	LIMITS MAX	LIMITS REPLACE
101	Nut-Hex, Shear, Slotted	150	250	
102	Nozzle-No. 1 Bearing, Assy of 50 lb - in. maximum after mating faces contact.			

R
R



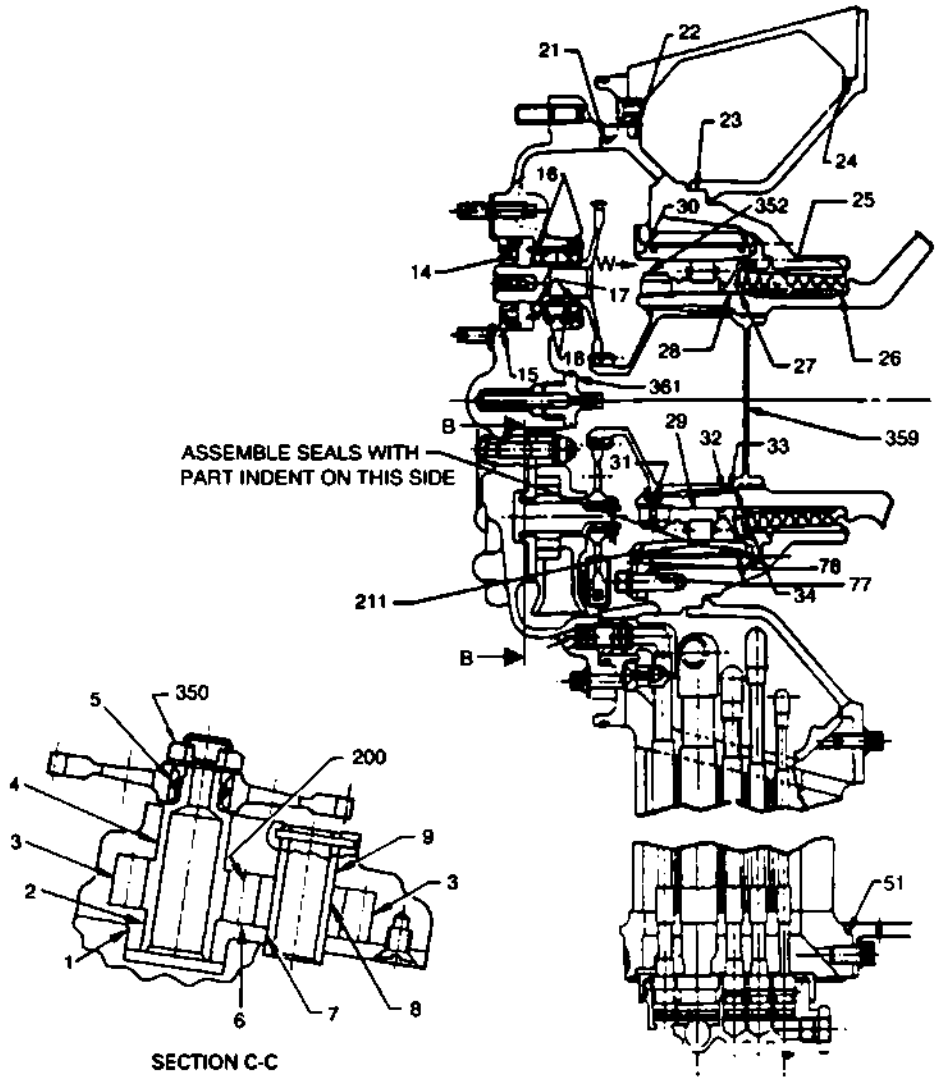
VIEW SHOWING
EARLIER, NON-OIL-DMPED
NO. 1 BEARING



SECTION B-B

VIEW W

L-H4806X (0601)
PW C



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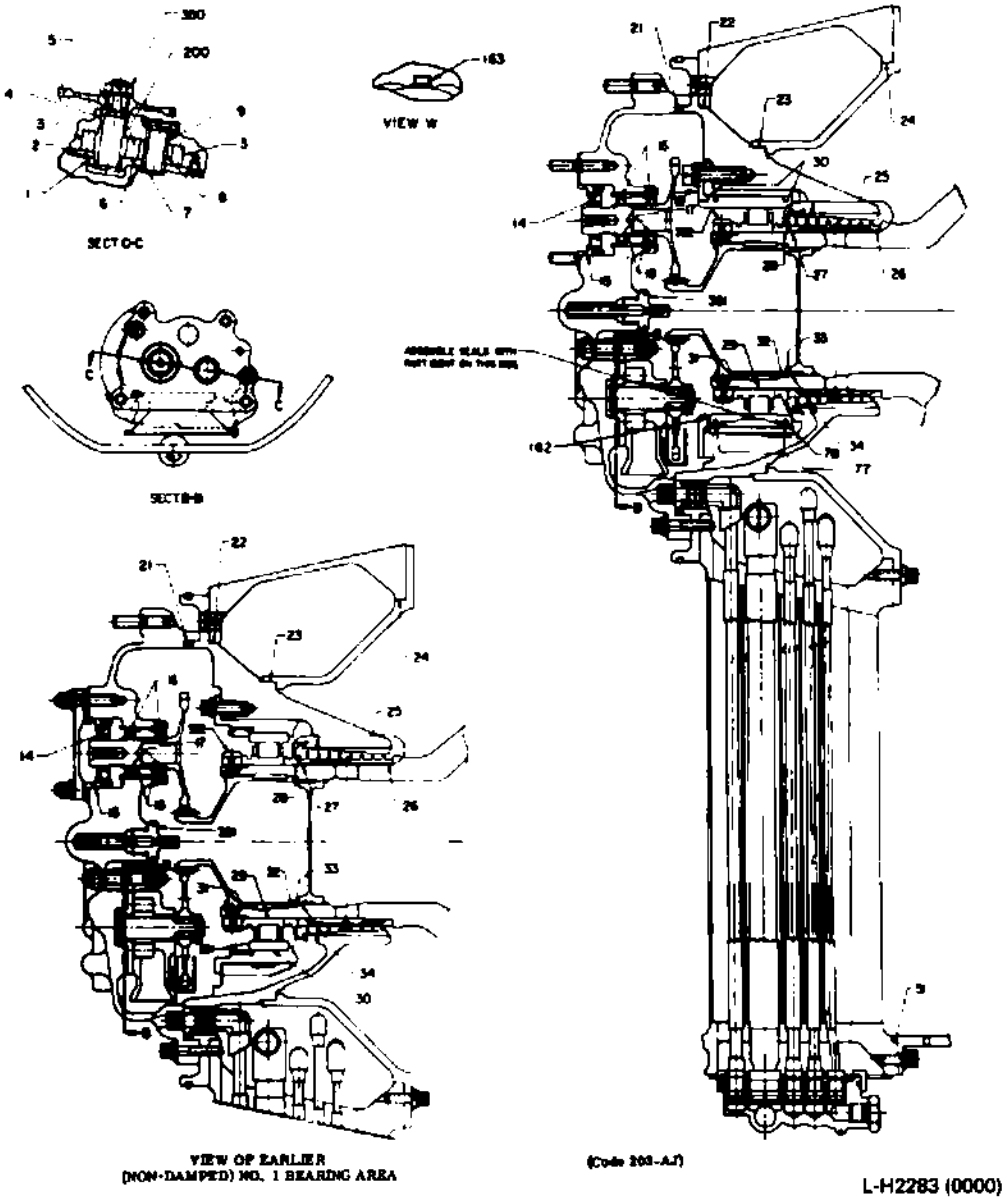
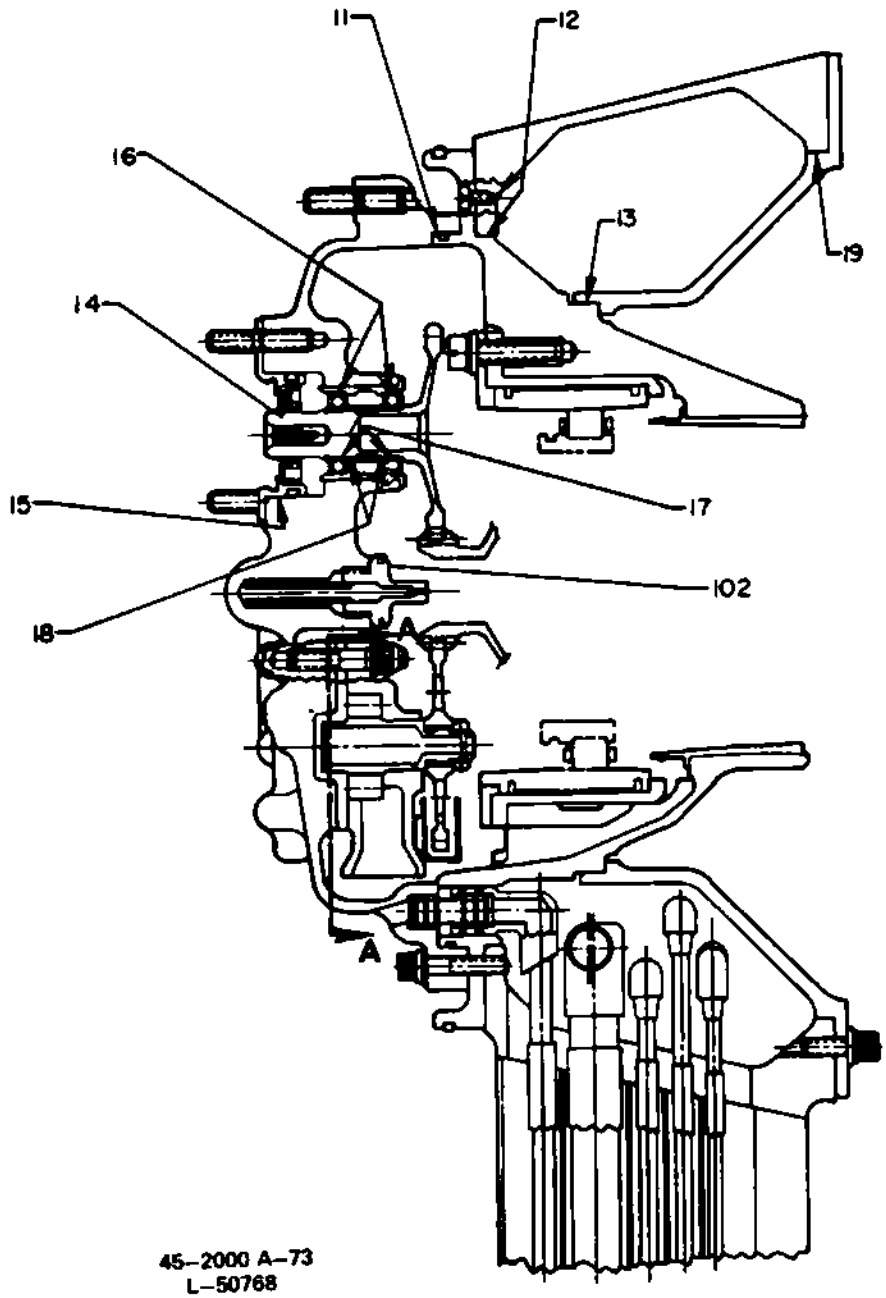
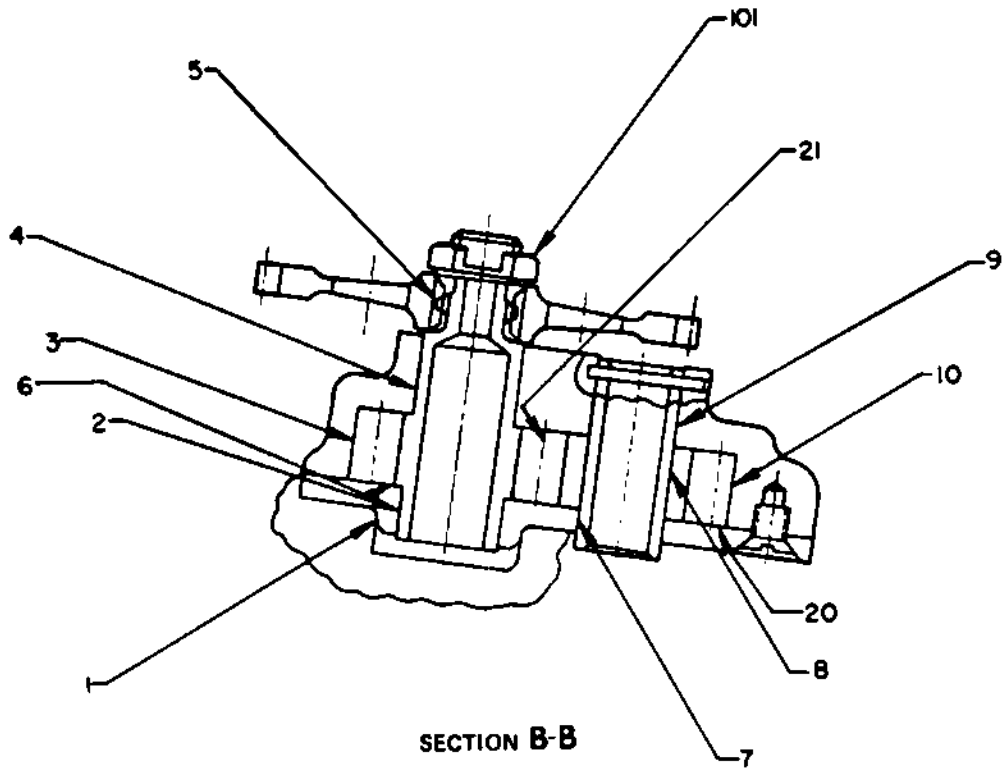


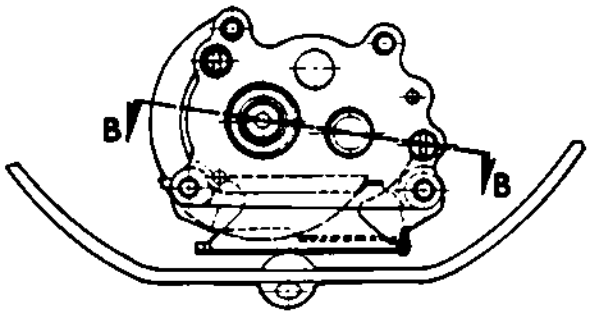
Front Accessory Drives
Support Clearance Chart
(JT8D-11)(Code 203)
Figure 402
(Task 72-21-00-990-003)



Front Accessory Drives
Support - Fits And Clearances
(JT8D-15,-15A,-17,-17A,-17R
R and -17AR) (45-2000A-73)
R Figure 403 (Sheet 1)
(Task 72-21-00-990-003)



SECTION B-B



SECTION A-A

45-2000 B-73
L-50769

Front Accessory Drives
Support - Fits And Clearances
(JT8D-15,-15A,-17,-17A,-17R
R and -17AR) (45-2000B-73)
R Figure 403 (Sheet 2)
(Task 72-21-00-990-003)

FAN INLET CASE - DESCRIPTION-00

Task 72-23-01-990-001:

1. Fan Inlet Case Assembly

See Figure 1.

A. The fan inlet case contains 19 equally spaced vanes, 18 of which have two internal ribs running the length of the vane. These ribs divide the hollow portion of the vanes into three passageways. The vane at the 6 o'clock position also contains the two internal ribs running the length of the vane, however, in this instance all three passageways are used to conduct tubing. The center passageway of this vane is filled with a rubber compound to dampen tube vibration.

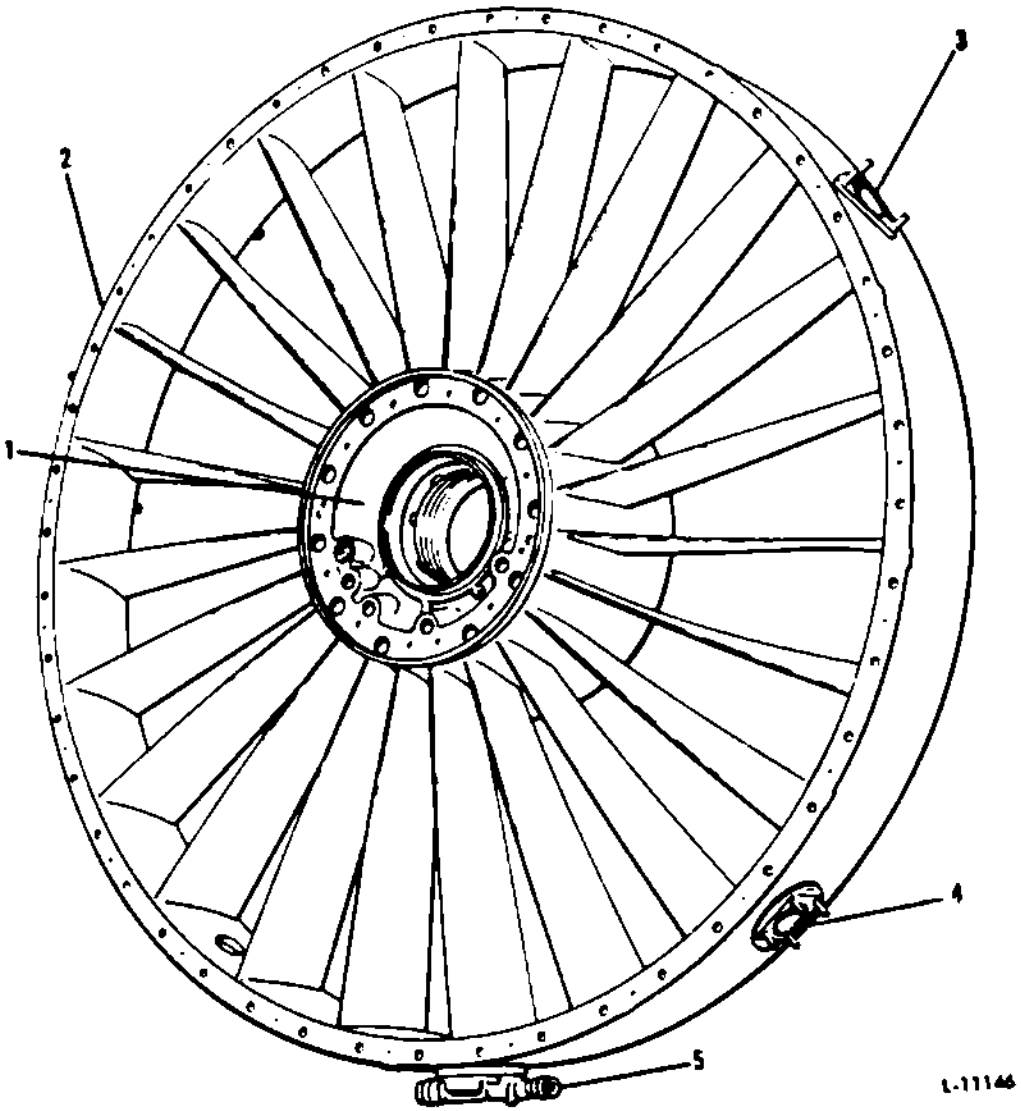
B. The vanes are brazed between titanium inner and outer shroud cases. A welded ring, brazed in place, adds structural rigidity and forms the outer wall of the outer case. Studs in rear flange are engaged by locknuts to hold case to front compressor case.

C. Five tubes are routed through the three passageways between the outer and inner case in the vane at the 6 o'clock position; the No. 1 bearing oil pressure tube, No. 1 bearing oil scavenge tube, No. 1 bearing breather tube, the tachometer conduit tube, and the compressor inlet air pressure tube which senses Pt2 from the airframe nose cone.

D. A five passage tube connector is secured to the bottom of the case, as is a water drain screen and plug assembly.

E. Two bosses (four studs each) are located on the outer case near the bottom, one on each side. The engine pressure probe is located in the boss on the right and the temperature probe boss is located on the left.

F. There are two anti-icing air bosses (three studs each), at the approximate ten and two o'clock positions, brazed in the outer wall of the case. Anti-icing air passages are formed within the case to permit the air to flow between the outer wall and outer shroud, inward through the hollow vanes, and discharge forward through the front of the inner shroud case.



1. No. 1 Bearing Front Support
2. Fan Inlet Case
3. Boss, Inlet Case
4. Boss, Inlet Case
5. Connector Assembly

Fan Inlet Case and No. 1
Bearing Front Support
Figure 1
(Task 72-23-01-990-001)

Task 72-23-01-300-001:

1. Fan Inlet Case "A" Flange Helical Coil Insert Replacement

A. Procedure

(1) Torque check self-locking capability of helical coil inserts. Helical coil inserts with less than 6.5 lb-in. should be replaced.

(2) For helical coils which do not meet the minimum torque requirements, replace by following procedure:

(a) Use extracting tool PN 1227-6 to remove damaged insert.

(b) Place new insert on tip of insert tool PN 7552-2 and install insert. Top face of first coil to be 1.0 - 1.5 pitch below surface. Break off drive tang with break-off tool PN 3692-5 and retrieve tangs with a magnetized rod.

(c) Torque check self locking capability of new helical coil inserts. Helical coil inserts should have break away torque of at least 6.5 lb-in.

(d) If torque is still less than recommended, remove newly installed helical coil insert and install oversized helical coil insert using insert tool PN 7552-2.

(e) Repeat torque check. If minimum torque is still not met, remove case from engine and proceed with threaded plug repair provided in engine manual.

Task 72-23-01-300-002:

2. Fan Inlet Case, Guide Vane Crack Repair

A. Procedure

CAUTION: PRIOR TO STOP-DRILLING CRACKS, REVIEW GUIDELINES IN CHAPTER/SECTION 72-20-00, INSPECTION/CHECK.

(1) Use dye check inspection to establish ends of crack.

(2) Stop-drill just ahead of end of crack with 3/32 inch drill.

(a) Use a new drill for each hole.

(b) Avoid excessive force on drill to prevent burrs on inner surface as drill breaks through.

(c) Keep drill speed below 1100 rpm.

(3) Finished hole must be of good quality (no external burrs, ragged or sharp edges permissible).

(4) After stop-drilling crack repeat dye check inspection to verify that crack does not extend beyond hole.

(5) Following stop-drilling procedure, inlet case may be continued-in-service providing guidelines in Chapter/Section 72-20-00, Inspection/Check are observed.

NO. 1 BEARING SUPPORTS - DESCRIPTION-00

Task 72-23-02-990-001:

1. No. 1 Bearing Supports Description

A. No. 1 Bearing Front Support Assembly

(1) The No. 1 bearing front support assembly is mounted in the center of the compressor inlet case behind the front accessory drive support. It holds the No. 1 bearing outer race secured in a steel bushing in its ID by a nut and a flared rivet. Three puller slots in the rear lip of the bushing facilitate removal of the bearing outer race. The support, of cast aluminum, also holds an aluminum multi-stepped seal ring behind the bushing. The seal ring is secured in place by a flange near the front and a flared lip at the rear.

(2) Holes in the front flange of the support accommodate the oil and anti-icing air tubes.

B. No. 1 Bearing Rear Support

(1) Behind the front support is the No. 1 bearing rear support, cast from aluminum alloy in the shape of an open dish. This unit is a snap fit on the rear side of the front support and is bolted and lockwired to the rear flange of the inlet case inner shroud. It shares the supporting loads of the No. 1 bearing with the front support.

(2) Three puller lugs on the ID of the rear flange provide a means of removing the support from the inlet case.

COMPRESSOR SECTION - DESCRIPTION-00

Task 72-30-00-990-002:

1. COMPRESSOR SECTION

A. Fan Section

(1) To the rear of the inlet case, enclosing the fan section, are the front and rear fan cases, extending from Flange B to D. The fan is not a separate unit but is formed by the outer diameter of the first two stages of the front compressor and is described in greater detail with it. At the rear of the compressor section the compressed air enters the diffuser section.

B. Front Compressor Section

(1) The axial flow front (low pressure) compressor partially compresses the air that passes through the primary (inner) air stream of the engine, then delivers this air to the rear (high pressure) compressor. In addition, the larger first and second stage blades also accelerate the secondary (outer) air stream, which then passes through the fan discharge vanes and rearward through the annular duct. See Figure 1.

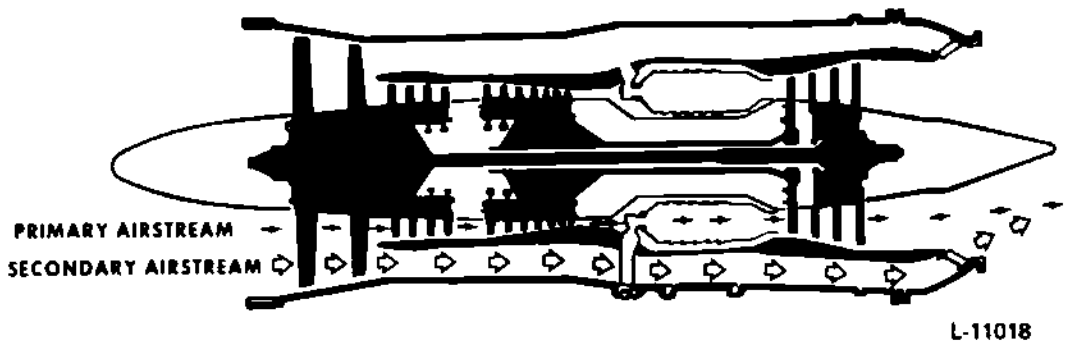
(2) The front compressor rotor (N1) is driven by the second, third, and fourth stage turbines through the front compressor drive (long) turbine shaft at N1 rotational speed. The front compressor drive turbine shaft is splined at the front into the front compressor rotor rear hub. The shaft and hub are held axially by a coupling threaded to the shaft and fixed in position by a coupling lock inside the front compressor rotor rear hub.

(3) Each compressor rotor is driven by a separate turbine, and each rotor is mechanically independent of the other.

C. Rear Compressor Section

(1) The purpose of the rear compressor is to further compress the air delivered by the front compressor and to then feed this air into the diffuser case and combustion section.

(2) The rear compressor rotor is driven by the first stage of the turbine through the rear compressor drive turbine (short) shaft. The turbine shaft splines onto the rear compressor rear hub and is retained by the turbine shaft coupling.



Engine Airstream
Figure 1
(Task 72-30-00-990-002)

Task 72-30-00-420-001:

1. Removal/Installation of Front Compressor Rotor First Stage Fan (Pod Or Wing Mounted Engines Only)

A. Removal

(1) Remove fan inlet section per Section 72-20-00, Maintenance Practices.

(2) Using layout dye indicate position of most unbalance on 1st stage hub and make reference mark on case.

NOTE: Do not subsequently turn rotor.

(3) Mark location of dynamic balance weights on retaining plate (blade lock) in reference to mark on case.

(4) Straighten keywasher at tierod nuts.

(5) Number tierod nuts and chart their location; remove tierod nuts, using two applicable wrenches. See Table 201.

NOTE: Mark location of tierod nuts on case flange. Keep tierods from turning.

(6) Remove 1st stage blade retaining plate.

(7) As an option, install a PWA 46125 Rail Support on engine as follows:

NOTE: The PWA 46125 Support Rail is available to use on B-727 pod engines and all DC-9 engines.

(a) Mount brace assembly on intermediate case mount rail, with angle brace positioned at outboard side of engine. Secure with lockpins.

NUT PN	WRENCH NO.
487721	PWA 12514
520453	PWA 32165

Tierod Nut Special Wrenches
Table 201

WARNING: ENSURE THAT HOIST AND TROLLEY ASSEMBLY ARE IMMOBILIZED ON BEAM BY MEANS OF LOCKPIN PROVIDED BEFORE HANDLING BEAM AND SUPPORT ASSEMBLY.

(b) With beam attached to rear support, lift beam and support, with hoist and trolley secured by lockpin, and lower onto engine. Bolt beam to brace assembly and secure rear plate of support to exhaust duct mount rail with lockpin.

(c) Remove lockpin securing hoist and trolley and move trolley into position over 1st stage hub and blades.

(8) With the aid of an assistant, remove 1st stage hub and blades using PWA 12018 Puller, PWA 12029 Eye, and PWA 46126 Sling (formerly PWA 33290).

(9) If 1st stage compressor hub and blades assembly is to be replaced with another assembly, remove front compressor rotor plug with PWA 12402 Wrench.

(10) Note position of brackets and remove nuts and bolts at rear flange of front fan case.

(11) Remove front fan case.

B. Installation
See Figures 201 through 204.

(1) Install front fan case.

NOTE: On Flange C bolts with PN 351584 spacers under nuts, torque bolts per Section 72-00, Removal/Installation, "Fits and Clearances," Reference 1034.

(2) Using PWA 46126 (formerly PWA 33290) Sling and PWA 12029 Eye and if used, the optional PWA 46125 Support Rail, position the front hub and blades on the front of the engine. Align holes in hub and tierods, matching layout dye numbers. Carefully engage tierods and slide hub to seat on spacer. Tap to seat snap fit on spacer.

(a) JT8D-1,-1A,-1B,-7,-7A,-7B

1 Install the positioning plate. Align the balance weight that was marked before at removal with reference mark on the case.

NOTE: Make certain to use only front compressor front hub which matches front tierods, positioning plate (blade lock), and 1st-to-2nd stage spacer in sets. Replacement hub and blades assembly must be statically balanced prior to installation.

NOTE: Engines incorporating front compressor front hub featuring semi-elliptical blade slots and thickened outer rim (Reference PN 640501) must use indicated key washer (Reference PN 639613 or 692630). Hubs prior to PN 504101 may use either old key washer (Reference PN 525837) or new key washer (Reference PN 639513 or 692630).

NOTE: PN 692630 key washers (SB 4971) must be used in sets with PN 771868 or 793937 positioning plate. PN 778901 hub (SB 4743) or PN 806101 hub (SB 4912) may use either PN 639611, 771868 or 793937 positioning plate. These positioning plates may be used with prior configuration of hubs.

2 Install new key washers (tabs inward), then thrust washers.

3 Lubricate tierod nuts with PWA 521 engine oil and install numbered tierod nuts in same locations from which they were removed.

4 Turn 16 tierods into anchor nuts in 2nd to 3rd stage spacer. Tighten tierods in anchor nuts to 50 lb-in., then back tierods out 90 - 450 degrees until gage pin grooves are aligned as shown in Figure 204.

5 Stretch tierods manually with a PWA 12652 Gage as follows:

a For tierods having approximately 9/16 inch long threaded end use following tools for installing tierod nuts: PWA 12652 Gage, PWA 12514 Wrenches, and PWA 12663 Rods. Install spacer ring of gage on No. 1 hub between body of gage and No. 1 bearing nut.

b For tierods having approximately one inch long threaded end, use following tools: PWA 12652 Gage, PWA 12514 Wrenches, and PWA 12664 Rods. Install spacer ring of gage on No. 1 hub between hub shoulder and gage body.

c Install applicable 16 rods in tierod grooves.

d Install 16 wrenches on tierod nuts.

e Mount gage on No. 1 hub so that springloaded indicator holder locates wrench and engages rod; secure gage with No. 1 bearing retaining nut using PWA 47287 Wrench.

f Set 16 gage indicators to zero with probes bottoming in tierod groove.

g Tighten nuts, simultaneously in pairs in 50 lb-in. increments, as shown, until torque of 360 - 400 lb-in. is reached.

NOTE: Keep tierods from turning.

h Recheck all tierod nuts and, if necessary, adjust nut to required torque.

i Loosen one pair of nuts, simultaneously, to zero lb-in. and retighten to 0.020 - 0.021 inch tierod stretch. Repeat this procedure with each pair of nuts, in sequence shown, until all tierods have been stretched to 0.020 - 0.021 inch.

j Recheck all tierods and, if necessary, adjust directly to desired stretch value without reloosening.

NOTE: Centerline of tierod grooves must lie on bolt circle within 10 degrees either side of true position in direction shown. See Figure 204.

k Lock nuts in position by bending up key washer. See Figure 203.

6 Stretch tierods manually with a PWA 46056 Tierod Stretch Fixture or (or PWA 47935 Fixture for an extended-journal hub post-SB 5948) as follows:

a Tighten the 16 tierod nuts as follows:

- Tighten in pairs, 180 degrees apart, at the same time.

- Torque in 50 lb-in. increments to a final torque of 360 - 400 lb-in.

- Temporarily mark and tighten all tierod nuts in the sequence shown in Figure 204.

- When each pair of tierod nuts are tightened, hold the related tierods with two PWA 12514 Wrenches so that the tierods do not turn.

- Tierod slot alignment is not necessary with this procedure.

b After all of the tierod nuts have been torqued to the final value, do a torque check for all tierod nuts. If necessary torque to the final 360 - 400 lb-in. value. Torque in the sequence shown in Figure 204.

c Install the two PWA 12514 Wrenches on the tierods marked No. 1.

d Install the stretch fixture (PWA 46056 or PWA 47935 as applicable) on the front hub with the two dial indicators on the two tierods marked No. 1.

CAUTION: ADJUST THE TWO DIAL INDICATORS (IN THE MOUNT SLOTS) SO THAT THE INDICATOR STEMS JUST TOUCH THE TIEROD ENDS WHEN THE RETAINING NUT IS TIGHTENED. THIS PREVENTS DIAL INDICATOR DAMAGE.

e Secure the stretch fixture (PWA 47908 or PWA 47935 as applicable) to the hub with No. 1 bearing retaining nut. Handtighten nut with a PWA 47287 Wrench.

f Stretch the 16 tierod nuts as follows:

- Loosen the two tierod nuts marked No. 1 to zero torque.
- Set the two dial indicators to zero.

- Two operators must tighten the two tierod nuts marked No. 1 at the same time. Tighten until you get a tierod stretch of 0.020 - 0.021 inch for both tierods.

- Each tierod must not turn when it is stretched. Hold each tierod with a PWA 12514 Wrench.

Note: If the tierod is turned during the stretch procedure this will result in an incorrect stretch value.

- Remove all tools and do procedures c through f again, in the sequence shown in Figure 204, for the remaining 14 tierods.

g Remove all tools.

h Do a final safety check of all tierod nuts. Apply a torque of 200 - 250 lb-in. to each tierod nut. Nuts should not turn. If any nut turns, do the stretch procedure again for that pair of nuts.

i Bend all key washers as shown in Figure 203.

(b) JT8D-9,-9A,-11,-15,-15A,-17,-17A,-17R and -17AR.

1 Install the retaining plate. Align the balance weight that was marked before at removal with the reference marks on the case.

NOTE: Make certain to use only front compressor front hub which matches front tierods, retaining plate, and 1st-to-2nd stage spacer in sets. Replacement hub and blades assembly must be statically balanced prior to installation.

NOTE: PN 640601, 743301, 749801 or 750101 front compressor front hubs must be installed in sets with PN 803996 or 808145 blade retaining plate and PN 639617 or 762137 1st-to-2nd stage compressor rotor spacer. Later type blade retaining plates PN 803996 or 808145 may be used with PN 594301 hub or hub post-SB 5948, 5949 or 5950.

2 Install new key washers and then tierod spacers in place on retaining plate on front hub. See Figure 205.

3 Lubricate tierod nuts with PWA 521 engine oil and install numbered tierod nuts in same locations from which they were removed.

4 Turn 16 tierods into anchor nuts in 3rd stage disk. Tighten tierods in anchor nuts to 50 lb-in., then back tierods out 90 - 450 degrees until gage pin grooves are aligned as shown in Figure 204.

5 Stretch tierods manually with a PWA 32162 Gage as follows:

a Install 16 PWA 32163 Rods in tierod grooves.

b Install 16 PWA 32165 Wrenches on tierod nuts.

c Torque tierod nuts, as indicated in following step, in sequence shown in Figure 204, while holding tierods from turning with open end wrenches on rectangular part of PWA 32165 Wrenches.

d Tighten nuts, simultaneously in pairs, in 50 lb-in. increments up to 200 lb-in., then in 100 lb-in. increments until torque of 650 - 700 lb-in. is reached.

NOTE: Keep tierods from turning.

e Recheck all tierod nuts and, if necessary, adjust nut to required torque.

f Mount PWA 32162 Gage on No. 1 hub so that each springloaded indicator holder locates wrench and engages rod; secure gage with No. 1 bearing retaining nut using PWA 47287 Wrench.

g Loosen one pair of nuts, simultaneously, to zero lb-in. and retighten to 0.023 - 0.025 inch tierod stretch. Repeat this procedure with each pair of nuts, in sequence shown, until all tierods have been stretched to 0.023 - 0.025 inch.

NOTE: Keep tierods from turning.

h Recheck all tierods and, if necessary, adjust directly to desired stretch value without reloosening.

NOTE: Centerline of tierod grooves must lie on bolt circle within 10 degrees either side of true position in direction shown. See Figure 205.

i Lock nuts in position by bending up key washers. See Figure 203.

6 Stretch tierods manually with a PWA 46056 Tierod Stretch Fixture (PWA 47908 Fixture for an extended-journal hub post-SB 5948, 5949, or 5950) as follows:

a Tighten the 16 tierod nuts as follows:

- Tighten in pairs, 180 degrees apart, at the same time.

- Torque in 50 lb-in. increments to a final torque of 650 - 700 lb-in.

- Temporarily mark and tighten all tierod nuts in the sequence shown in Figure 204.

- When each pair of tierod nuts are tightened, hold the related tierods with two PWA 32165 Wrenches so that the tierods do not turn.

- Tierod slot alignment is not necessary with this procedure.

b After all of the tierod nuts have been torqued to the final value, do a torque check for all tierod nuts. Torque to the final 650 - 700 lb-in. value. Torque in the sequence shown in Figure 204.

c Install the two PWA 32165 Wrenches on the tierods marked No. 1.

d Install the stretch fixture (PWA 46056 or PWA 47908 as applicable) on the front hub with the two dial indicators on the two tierods marked No. 1.

CAUTION: ADJUST THE TWO DIAL INDICATORS (IN THE MOUNT SLOTS) SO THAT THE INDICATOR STEMS JUST TOUCH THE TIEROD ENDS WHEN THE RETAINING NUT IS TIGHTENED. THIS PREVENTS DIAL INDICATOR DAMAGE.

e Secure the stretch fixture (PWA 46056 or 47908) to the hub with the No. 1 bearing retaining nut. Handtighten the nut with a PWA 47287 Wrench.

f Stretch the 16 tierod nuts as follows:

- Loosen the two tierod nuts marked No. 1 to zero torque.

- Set the two dial indicators to zero.

- Two operators must tighten the two tierod nuts marked No. 1 at the same time. Tighten until you get a tierod stretch of 0.023 - 0.025 inch for both tierods.

- Each tierod must not turn when it is stretched. Hold each tierod with a PWA 32165 Wrench.

Note: If the tierod is turned during the stretch procedure this will result in an incorrect stretch value.

Remove all tools and do procedures c through f again, in the sequence shown in Figure 204, for the remaining 14 tierods.

g Remove all tools.

h Do a final safety check of all tierod nuts. Apply a torque of 400 - 450 lb-in. to each tierod nut. Nuts should not turn. If any nut turns, do the stretch procedure again for that pair of nuts.

i Bend all key washers as shown in Figure 203.

(3) If hub and blades assembly is not same assembly as was removed, install the rotor plug. Use a new packing lubricated with PWA 36500 Assembly Fluid and install the front compressor rotor plug with PWA 12402 Wrench. Tighten handtight only.

C. Postrequisites

(1) Install compressor inlet group per Section 72-20, Removal/Installation.

(2) Do an engine breather pressure check with Section 72-00, Adjustment/Test, Test G.

NOTE: It is permitted to operate the engine for up to 24 flight hours before the breather pressure check or a vibration check is done. This will make it possible for the aircraft to fly to a maintenance base that can do the breather pressure check.

Task 72-30-00-420-002:

2. Removal/Installation of 1st Stage Vanes Assembly and 2nd Stage Disk and Blades

A. Removal

(1) Remove 1st stage vane assembly by removing jackscrew plugs and using jackscrews to separate assembly.

(2) Install a locally fabricated tool to hold 2nd stage disk to 3rd stage disk.

(3) Mark their location and remove two nuts and two bolts that hold 1st-to-2nd stage spacer.

(4) Place spacer in PWA 9150 Protector (JT8D-1,-1A,-1B,-7,-7A, -7B) or PWA 32157 Protector (JT8D-9,-9A,-11,-15,-15A,-17,-17A,-17R and -17AR).

(5) If there is a triangular mark (point of most unbalance) on the spacer assembly, make a note of its location. Use PWA 11904 Puller to remove the 1st-to-2nd stage spacer.

(6) Pass PWA 16139 Puller through bore of 2nd stage disk and, using knocker action of puller, loosen 2nd stage disk.

(7) With aid of an assistant, remove disk and blades assembly.

B. Installation

(1) With the aid of an assistant, put the 2nd stage disk and blades assembly in position against the front flange of the 2nd-to-3rd stage spacer (JT8D-1 thru -7B) or the 3rd stage disk (JT8D-9 thru -17AR). If there is an unbalance mark on the spacer, put the unbalance mark on the 2nd stage disk and blades assembly 90

degrees counterclockwise from the mark on the spacer, then carefully install the disk on the tierods. Tap the disk carefully to install the disk tightly on the spacer or disk (the parts have a tight fit).

NOTE: Replacement assemblies must be statically balanced prior to installation.

(2) As an option, prior to installation of 1st stage stator, RTV damping material may be applied to stator, to decrease vibratory stresses for the prevention of severe wear on ID attachment around rivets and on lugs, as follows: See Figure 201 (Sheet 2).

(a) Assemble jackscrew plugs (14) into rear face of shoulder on rear fan case. Tighten plugs and lockwire.

(b) Apply a fillet of PWA 36029 (Dow Corning RTV 732) or PWA 36003 (G.E. RTV 159) to Figure 201 (Sheet 2), Index 3 area and a thin coat to Index 2 area. Assemble 1st stage stator to rear fan case within 15 minutes after coating.

(c) Coat Figure 201 (Sheet 2), Index 9 area on 1st stage stator with a thin, but complete, coat of RTV. Assemble front fan case to assembly within 15 minutes of RTV application.

(d) Clean any excess of coating material.

(e) Cure for 24 hours minimum before handling. Minimum total cure time at room temperature and 50 percent minimum humidity, before balancing, is 72 hours for PWA 36029 and 120 hours for PWA 36003.

(3) Install the 1st-to-2nd stage spacer, large seal rearward (and the unbalance mark if there is one, 90 degrees counterclockwise) on the 2nd stage disk. Tap the spacer to install it tightly into position.

(4) Install 1st stage compressor stator, large diameter forward, and seat into rear fan case. Install 14 jackscrew plugs into rear face of shoulder on rear case. Tighten plugs and lockwire.

(5) Install front fan case onto 1st stage compressor stator and rear case.

(6) Secure case with bolts and nuts, boltheads rearward.

(7) Install two bolts down into the spacer and 2nd stage disk, with one bolt approximately 90 degrees from the unbalance mark (if there is one on the spacer) and the second bolt 180 degrees from the first bolt. Install a washer and nut for each and torque the two nuts. Bend the tab washers.

C. Postrequisites

(1) Install compressor inlet group per Section 72-20, Removal/ Installation.

(2) Do an engine breather pressure check with Section 72-00, Adjustment/Test, Test G.

NOTE: It is permitted to operate the engine for up to 24 flight hours before the breather pressure check or a vibration check is done. This will make it possible for the aircraft to fly to a maintenance base that can do these checks.

Task 72-30-00-990-001:

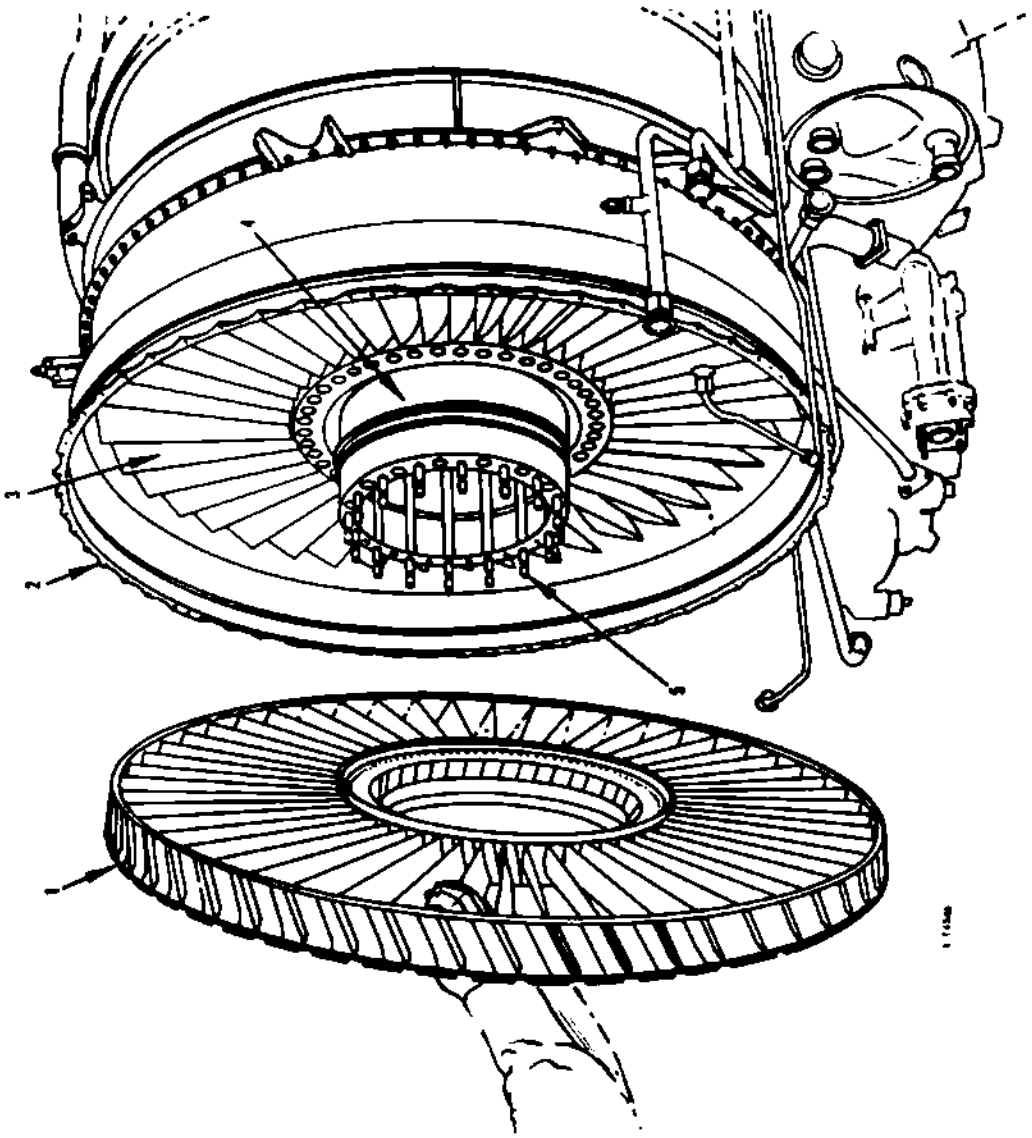
3. Numerical Tool List

A. Support Equipment

PWA 9150	Protector - 1st-to-2nd Stage Spacer (JT8D-1,-1A,-1B,-7,-7A,-7B)
PWA 11904	Puller - Disk Spacers and 2nd Stage Disk
PWA 12018	Puller - Knocker No. 1 Hub
PWA 12029	Eye - No. 1 Hub
PWA 12402	Wrench - Front Compressor Rotor Plug
PWA 12514	Wrench - Front Compressor Front Tierod Nut
PWA 12515	Stretch Gage - Front Compressor Front Tierods (Superseded by PWA 12652 and PWA 12663 or PWA 12664)
PWA 12652	Gage - Stretch, Front Compressor Front Tierods (Supersedes PWA 12515)
PWA 12663	Rod Set - Front Compressor Front Tierod Stretch Gage
PWA 12664	Rod Set - Front Compressor Front Tierod Stretch Gage
PWA 16139	Puller - Disk and Blade Assembly
PWA 32157	Protector - 1st-to-2nd Stage Spacer (JT8D-9,-9A,-11,-15,-15A,-17,-17A,-17R and -17AR).
PWA 32162	Gage - Tierod Stretch (Mechanical Stretch Only)

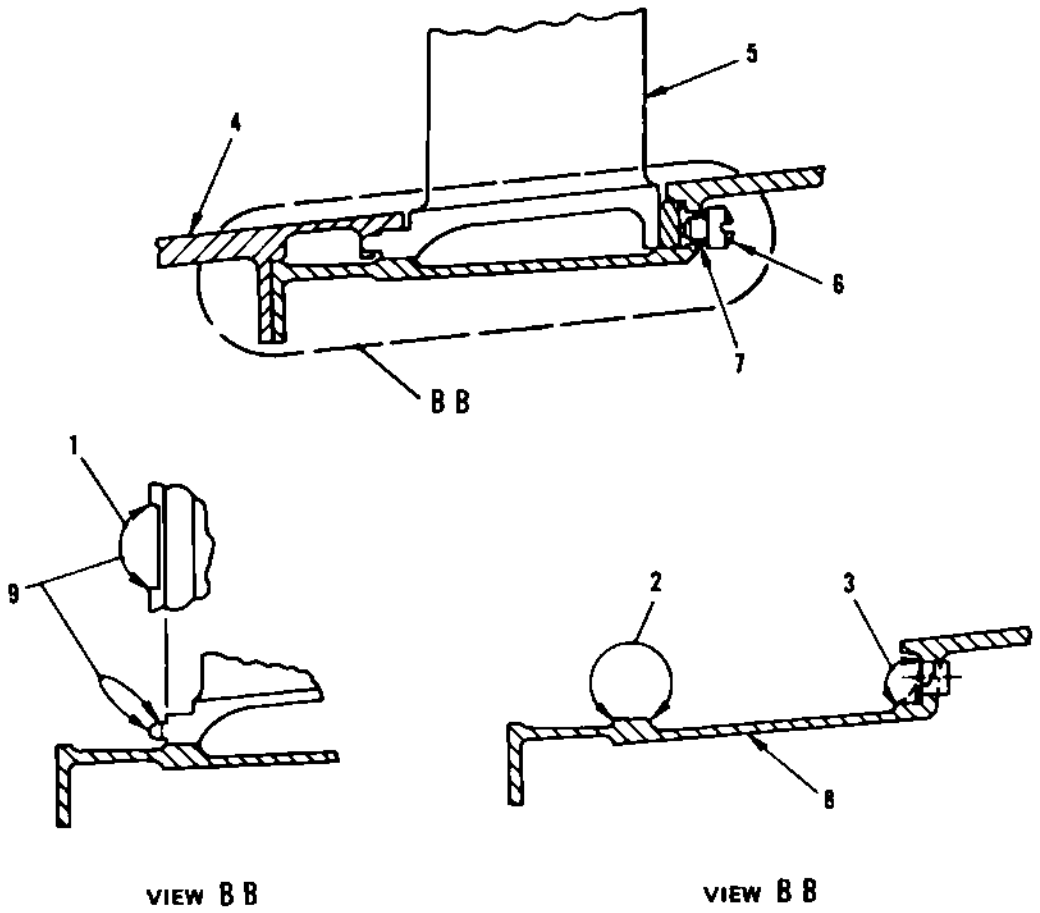
(CONTINUED)

PWA 32163	Rod - Stretch Gage (Mechanical Stretch Only)
PWA 32165	Wrench (16) (Mechanical Stretch Only)
PWA 33290	Sling - 1st Stage Fan Hub And Blades (Replaced by PWA 46126)
PWA 46056	Fixture - Tierod Stretch (Mechanical Stretch Only) (Non-Extended-Journal Hubs Only)
PWA 46125	Support Rail
PWA 46126	Sling (Replaces PWA 33290)
PWA 47287	Wrench - No. 1 Bearing
PWA 47908	Fixture - Tierod Stretch (Mechanical Stretch Only) (JT8D-9 Thru -17AR Extended-Journal Hubs Only)
PWA 47935	Fixture - Tierod Stretch (Mechanical Stretch Only) (JT8D-1 Thru -7B Extended-Journal Hubs Only)



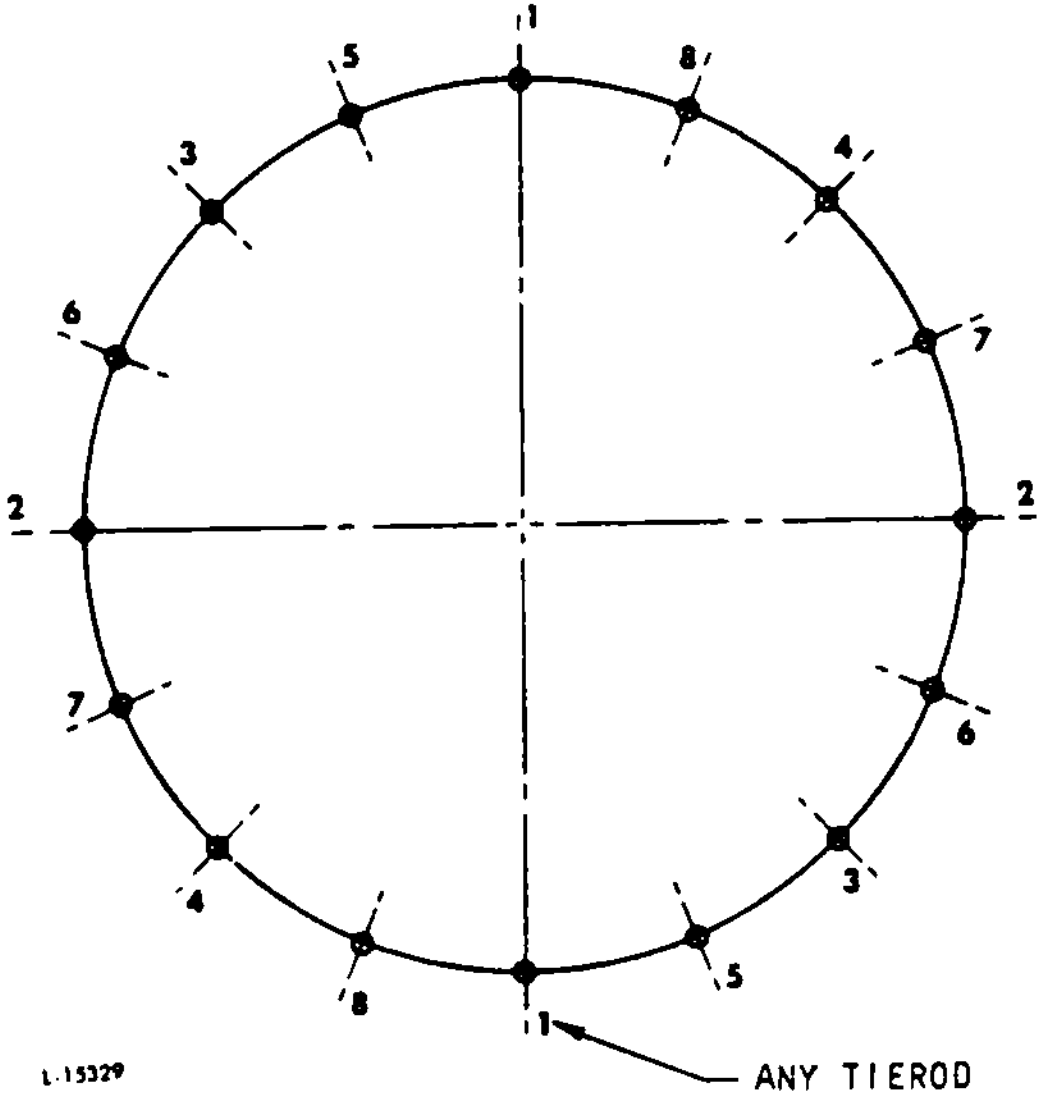
1. First Stage Compressor Stator
2. Rear Fan Case
3. Second Stage Disk and Blade Assy
4. First-to-Second Stage Spacer
5. Front Compressor Rotor Front Tierods

First Stage Compressor
Stator Installation
Figure 201 (Sheet 1)
(Task 72-30-00-990-001)

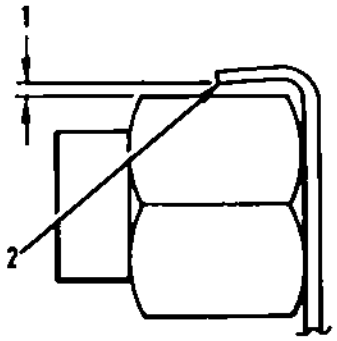


1. 51 Places
2. Apply Coating To This Area
3. Apply A Fillet Of Coating To This Area
4. Front Fan Case
5. First Stage Stator
6. Machine Screw (Reference PN 480771)
7. Insert (Reference PN 480772)
8. Rear Fan Case
9. Apply Coating To This Area

First Stage Compressor
Stator Installation
Figure 201 (Sheet 2)
(Task 72-30-00-990-001)



Tierod Sequence
Figure 202
(Task 72-30-00-990-001)

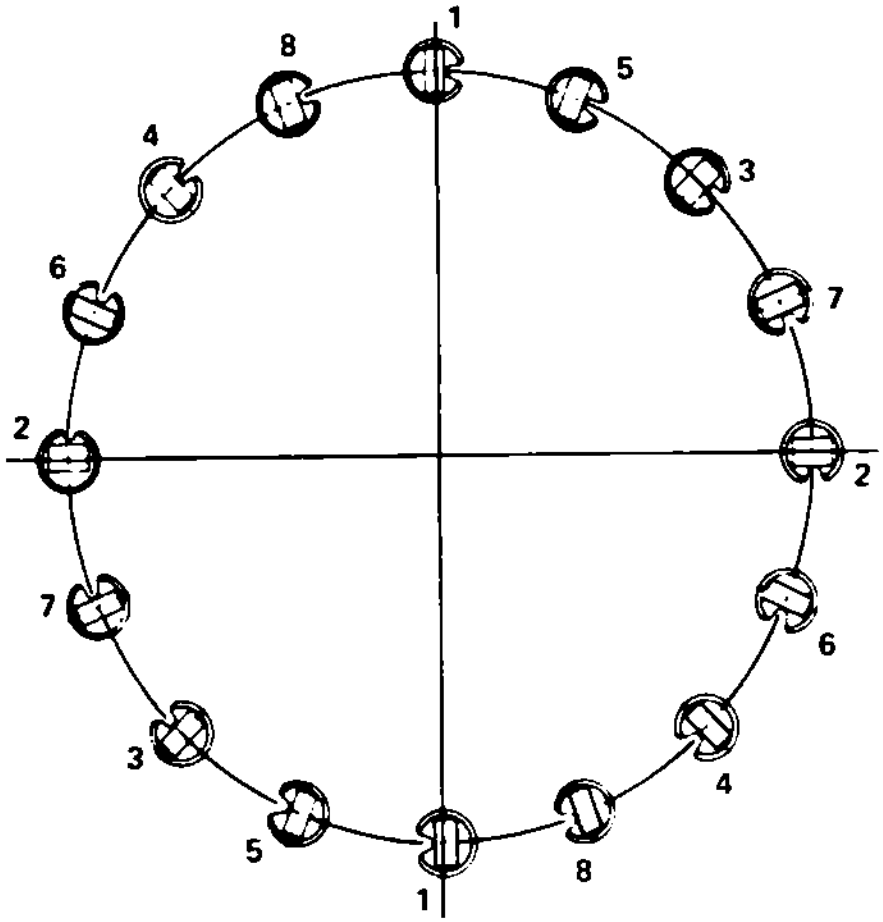


**TYPICAL VIEW
OF
KEYWASHER INSTALLATION**

**L-49425
6-76**

1. 0.020 Inch Maximum
2. Dimension At This Corner Only

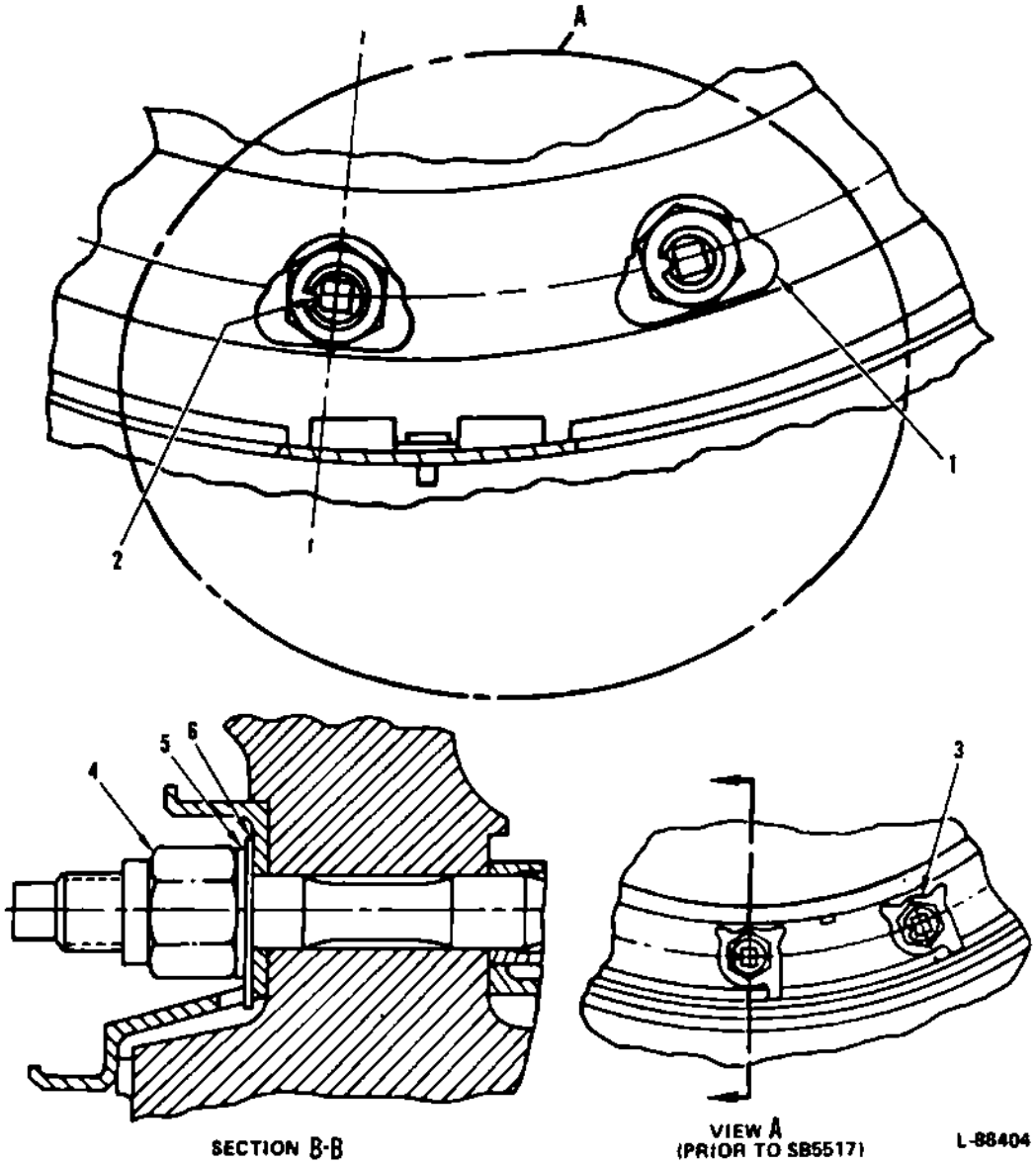
Tierod Nut Key Washer Installation
Figure 203
(Task 72-30-00-990-001)



SCHEMATIC VIEW
FRONT TIERODS

L-15721
6—75

Schematic View Of Front Tierods
Figure 204
(Task 72-30-00-990-001)



Front Tierod/Key
Washer Installation
Figure 205
(Task 72-30-00-990-001)

1. Key Washer (Without Antirotation Tab)
2. Centerline Of Tierod Groove Must Be On Tierod Circle Within 10 Degrees Either Side Of True Position As Shown.
3. Key Washer (With Antirotation Tab)
4. Tierod Nut
5. Tierod Spacer (Formerly Tierod Thrust Washer)
6. Key Washer (Typical)

Key to Figure 205

FRONT COMPRESSOR ROTOR AND STATOR ASSEMBLY - DESCRIPTION-00

Task 72-33-00-990-001:

1. Front Compressor Section

A. Front Compressor Rotor and Stator Assembly

(1) The front compressor rotor and stator assembly consist of the six stage front compressor rotor, the front compressor front and rear cases, and the vanes and shrouds for stages one through five. The sixth stage vanes are in the compressor intermediate case and will be described with it.

(2) The front fan case enclosed the first stage blades and the front compressor fan case encloses the first stage vanes, and the second stage blades. The rear stages of the rotor are enclosed within the inner shroud of the fan discharge case vane assembly and the front compressor section inner duct.

(3) The numbering of the blade stages from front to rear is one through six. The first and second stage blades are considerably larger than the rest and are also referred to as "fan blades". The vane stages, to the rear of their blade stages, are numbered in the same manner, one through five in the rotor and stator assembly and stage six in the compressor intermediate case.

B. Front Compressor Rotor

(1) The front compressor rotor has a front hub (which serves as the first stage disk), a rear hub (which serves as the fourth stage disk), four rotor disks, six stages of blades secured in the hubs and disks, five rotor disk spacers, and two sets of tierods. JT8D-9,-9A,-11,-15,-15A,-17,-17A,-17R and -17AR models have only four separate rotor disk spacers. The 3rd stage disks of these models incorporate an integral spacer. This rotor is driven by the front compressor drive turbine rotor.

(2) The front hub, the first-to-second stage spacer, the second stage disk, and the second-to-third stage spacer are held together by 16 front tierods. The second-to-third stage spacer, the third stage disk, and the rear hub, and the fifth and six stage disks are held together, with the spacers between, by 12 rear tierods. The front and rear sections of the rotor are held together at the front and rear flanges of the second-to-third stage spacer.

(3) The rotor disk spacers each have two knife-edge airseals on their OD. These knife-edges rotate just inside matching seal rings on the ID of the vane and shroud assemblies. The knife-edge airseal of the second-to-third stage spacer is incorporated in the rear flange of the spacer and matches the ring inside the second stage vanes.

(4) The first stage compressor blades (fan) are dovetailed into matching grooves in the front hub rim and are retained by a tab at the leading edge of the blade root that prevents rearward movement and a positioning ring that prevents forward movement. The positioning ring is retained by the rotor tierods. The second stage blades (fan) are held in the disk by a pin-joint attachment with a flared rivet. See Figure 1.

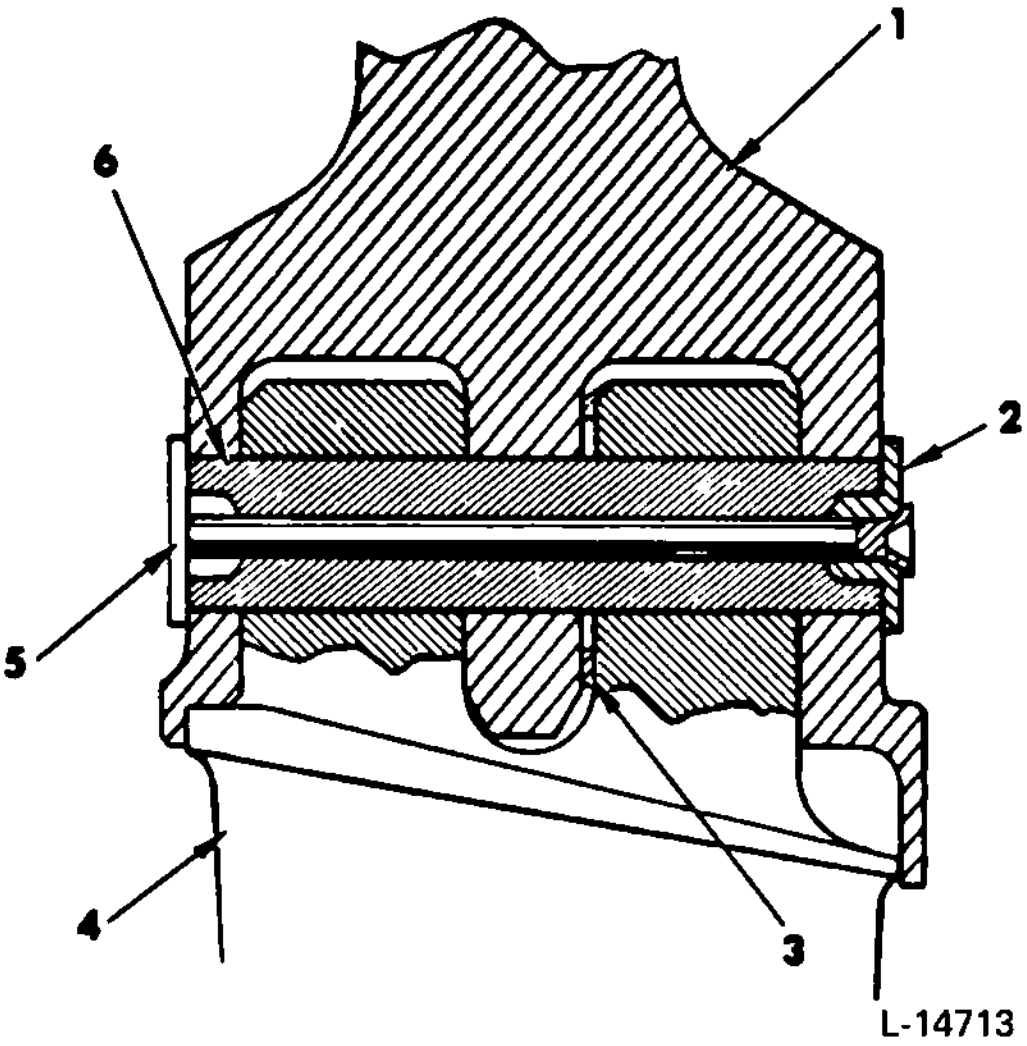
(5) The third through the sixth stages of blades are fastened to the disks by dovetail root sections which fit into broached slots in the disk rim. Tablocks fit in the bottom of the blade root (and disk slots) and are bent inward at the tab to effect blade locking.

(6) The front hub and the second stage disk are titanium. The third stage disk is steel; the rear hub and the fifth and sixth stage disks are titanium.

(7) The first through sixth stage blades are titanium.

C. Front Compressor Rotor Rear Hub Coupling

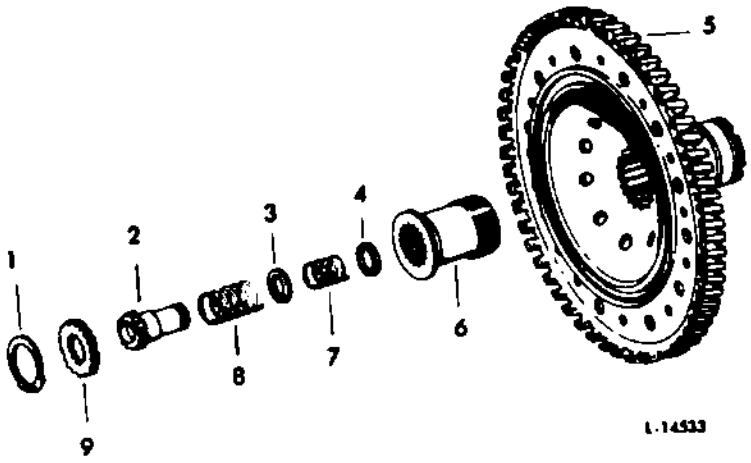
(1) The front compressor drive turbine shaft splines into the front compressor rotor rear hub. The shaft and the hub are held axially by a hollow front compressor drive coupling, threaded to the shaft and fixed in position by a coupling lock inside the front compressor rotor rear hub. See Figure 2.



1. Disk
2. Washer
3. Washer
4. Blade
5. Rivet
6. Pin

Blade Pin Root Attachment
Figure 1
(Task 72-33-00-990-001)

FRONT COMPRESSOR ROTOR AND STATOR ASSEMBLY - DESCRIPTION-00



1. Ring - Lockring Retaining
2. Lock
3. Ring - Retaining
4. Ring - Retaining
5. Hub - Front Compressor Rotor, Rear
6. Coupling
7. Spring - Rear
8. Spring - Front
9. Lockring

Coupling - Front Compressor Rotor
Figure 2
(Task 72-33-00-990-001)

Task 72-33-01-990-001:

1. Front Compressor Blades

A. Inspection Limits

(1) See Section 72-00, Inspection.

B. Disk and Blade Assembly - Removal and Installation

(1) See Section 72-30, Maintenance Practices for Removal and Installation of 1st and 2nd stages.

Task 72-33-01-220-001:

2. Blade Replacement Constraints

A. Replacement of 1st and 2nd stage compressor blades may be accomplished without static balancing in either of the two following ways:

(1) Moment Weight Method - Preferred

(a) Replace blades by moment weight matched sets. A matched set of blades is defined as a set of blades having the same moment weight classification letters.

(b) Damaged blades may be replaced individually provided the replacement blade has the same moment weight classification letter as the blade being replaced.

(2) Mass Weight Method - Optional

(a) Damaged blades may be replaced individually provided the replacement blade is within 0.3 ounces of blade being replaced.

(3) Table 201 provides correct blade slot locations (by model and stage).

B. Replacement Sets Consist of the Following No. of Blades:

	JT8D-1,-1A,-1B, -7A,-7B	JT8D-9,-9A,-11,-15, -15A,-17,-17A, -17AR,-17R
First Stage	2	3
Second Stage	(Pre SB 6425) 2 (Post SB 6425) 4	2

C. First and Second Stage Compressor Blades may be replaced at maintenance without the use of static balance provided preferred or optional method above is utilized.

(1) Static balance is advisable provided equipment is readily available.

(2) Do the applicable tests shown in the Repair Reference Table in Section 72-00, Adjustment/Test.

NOTE: Do tests during subsequent engine operation.

Task 72-33-01-420-001:

3. Blade Replacement Procedure

A. First Stage Blade Removal

(1) Remove disk and blade assembly (see Section 72-30 Maintenance Practices).

(2) Remove 1st stage blade positioning ring from front hub. Mark location as required.

1st Stage JT8D-1, -1A, -1B, -7, -7A, -7B (30 Blades)

1-16	4-19	7-22	10-25	13-28
2-17	5-20	8-23	11-26	14-29
3-18	6-21	9-24	12-27	15-30

2nd Stage JT8D-1, -1A, -1B, -7, -7A, -7B (42 Blades)

1-22	6-27	11-32	16-37	21-42
2-23	7-28	12-33	17-38	
3-24	8-29	13-34	18-39	
4-25	9-30	14-35	19-40	
5-26	10-31	15-36	20-41	

1st Stage JT8D-9,-9A,-11,-15,-15A,-17,-17A,-17AR,-17R (27 Blades)

1-10-19	4-13-22	7-16-25
2-11-20	5-14-23	8-17-26
3-12-21	6-15-24	9-18-27

2nd Stage JT8D-9,-9A,-11,-15,-15A,-17,-17A,-17AR,-17R (40 Blades)

1-21	5-25	9-29	13-33	17-37
2-22	6-26	10-30	14-34	18-38
3-23	7-27	11-31	15-35	19-39
4-24	8-28	12-32	16-36	20-40

Blade Slot Locations
Table 201 (Continued)

(3) Loosen blades adjacent to blade (or blades) to be replaced, by working blades forward a small distance at a time. Loosen enough blades to allow removal of blades to be replaced.

B. First Stage Blade Replacement

(1) With blades still in loosened forward position, insert replacement blades. Working back and forth across area of loosened blades, tap all blades down into tight position.

(2) Replace 1st stage positioning ring.

C. Second Stage Blade Removal

(1) Remove disk and blade assembly (Section 72-30 Maintenance Practices).

CAUTION: WHEN REMOVING RIVETS FROM 2ND STAGE ROTOR ASSEMBLY HAVING PIN-AND-RIVET TYPE BLADE RETENTION (WITHOUT WASHERS UNDER RIVET FLARE), REMOVE RIVETS ONLY BY DRIVING THEM OUT WITH PUNCH OF PROPER SIZE. DRILLING OR OTHER METHODS MAY DAMAGE COUNTERSUNK SURFACE ON END OF BLADE PIN AND RENDER PIN UNFIT FOR REINSTALLATION.

(2) Use a punch and hammer to remove the rivets.

CAUTION: TO PREVENT SCORING OF ROOT TANG, RETAINING PIN MUST BE ALIGNED TO BE REMOVED. PUSH BLADE, BY HAND, TOWARD CENTER OF DISK TO FACILITATE REMOVAL.

(3) Remove rivets and pins to be replaced. Remove blades and thrust washers.

D. Second Stage Blade Replacement
See Figure 201.

(1) Position 2nd stage disk on assembly base. Select tooling as follows:

(a) JT8D-1,-1A,-1B,-7,-7A,-7B disks other than PN 570402, 740502: use PWA 12654 or PWA 33498 Base; PN 570402, 740502: use PWA 33498 Base. Position disk on base front face down.

(b) JT8D-9,-9A,-11,-15,-15A,-17,-17A,-17R,-17AR Position disk on PWA 32159 Base rear face down.

NOTE: Do not install upper clamping ring of base until new blades and rivets have been installed as directed.

(2) Insert replacement blade or blades.

CAUTION: TO PREVENT SCORING OF ROOT TANG, BLADE MUST BE PUSHED BY HAND TOWARD THE CENTER OF THE DISK, AND RETAINING PIN INSTALLED WHILE HOLDING BLADE IN POSITION. RETAINING PIN MUST FIT EASILY INTO DISK AND BLADE MUST NOT BE HAMMERED INTO POSITION.

(a) JT8D-1,-1A,-1B,-7,-7A,-7B: For Pre SB 6425 assemblies, install each blade with a thrust washer between the rearward blade tang and the center rail of the disk. Install the blade retaining pin and bushing from above, and a rivet from underneath, with the manufactured rivet head at the front face of the disk.

NOTE: Pre SB 6425 PN 715930 Washers are interchangeable with PN 564777 Washers in sets only.

CAUTION: Pre and Post SB 6425 washers and blade assemblies must be used in sets at each location. If they are not, rotor balance can be affected. For example: If it is necessary to replace a damaged Pre SB 6425 blade, two Post SB 6425 washers and four Post SB 6425 blades must be installed.

(b) JT8D-1,-1A,-1B,-7,-7A,-7B: For Post SB 6425 assemblies, install a two-hole washer over the disk center rail (one washer is used with two

adjacent blades). Install two blades on the disk at the washer location. Install the blade retaining pins and bushings from above, and the rivets from below, with the manufactured rivet head at the front face of the disk.

(c) JT8D-9,-9A,-11,-15,-15A,-17,-17A,-17R,-17AR (Pre-SB 6011): Install each blade with a thrust washer between each tang of the blade root and the center rail of the disk (see figure). If the assembly is the single thrust washer type, install only one washer between the rearward blade tang and the center rail of the disk. Install the blade retaining pin from above, and a rivet from underneath, with the manufactured rivet head at the rear face of the disk.

NOTE: PN 715933 or 715934 Washers are interchangeable with PN 581742 or 698256 Washers, respectively, in sets only. For engines incorporating PN 745702 or 746802 Disk, use two washers (PN 715934), one on each side of disk center rail. Post-SB 6011 engines use a two-hole washer that must be installed over the disk center rail first. One SB 6011 thrust washer is necessary for every two adjacent blades.

(d) JT8D-9,-9A,-11,-15,-15A,-17,-17A,-17R,-17AR (Post-SB 6011): Install a two-hole thrust washer over the disk center rail first. Align the holes in the washer with two adjacent pin holes in the disk center rail (one thrust washer is used with two adjacent blades). Install two blades on the disk at the thrust washer location. Install the blade retaining pins from the front of the disk. Install the pin rivets with the manufactured head at the rear face of the disk. Install the remaining blades with the same procedure.

(e) Install upper clamping ring of base to secure disk and blades assembly.

(f) Apply PMC 9630 extreme pressure grease to rivet end to facilitate flare and minimize tool wear.

CAUTION: IN FOLLOWING PROCEDURE DO NOT ATTEMPT TO FLARE BLADE RIVETS BEYOND LIMITS SPECIFIED. EXCESSIVE RIVET FLARING CAN DAMAGE RIVETS.

(g) Insert PWA 33473 Anvil in holder detail of PWA 33533 (formerly PWA 12653) Riveter. Hold riveter against head of blade retaining pin so that anvil is positioned over end of rivet and sleeve of riveter is held firmly against blade retaining pin face. Strike holder shank with light (one-pound) hammer to flare rivet to specifications. Two or three light hammer blows (rather than single heavy blow) will result in improved flare and tighter blade pin gap.

NOTE: As necessary, adjust PWA 33533 Riveter using wrenching flats and internal nut on anvil holder so that anvil does not quite contact unflared rivet end when riveter is in position on disk.

(3) Inspect rivet and reject for failure to meet following requirements:

(a) Cracks in rivet flare.

(b) Minimum spread of flared end of rivet (see figure).

(c) Washer gap and tightness (see figure).

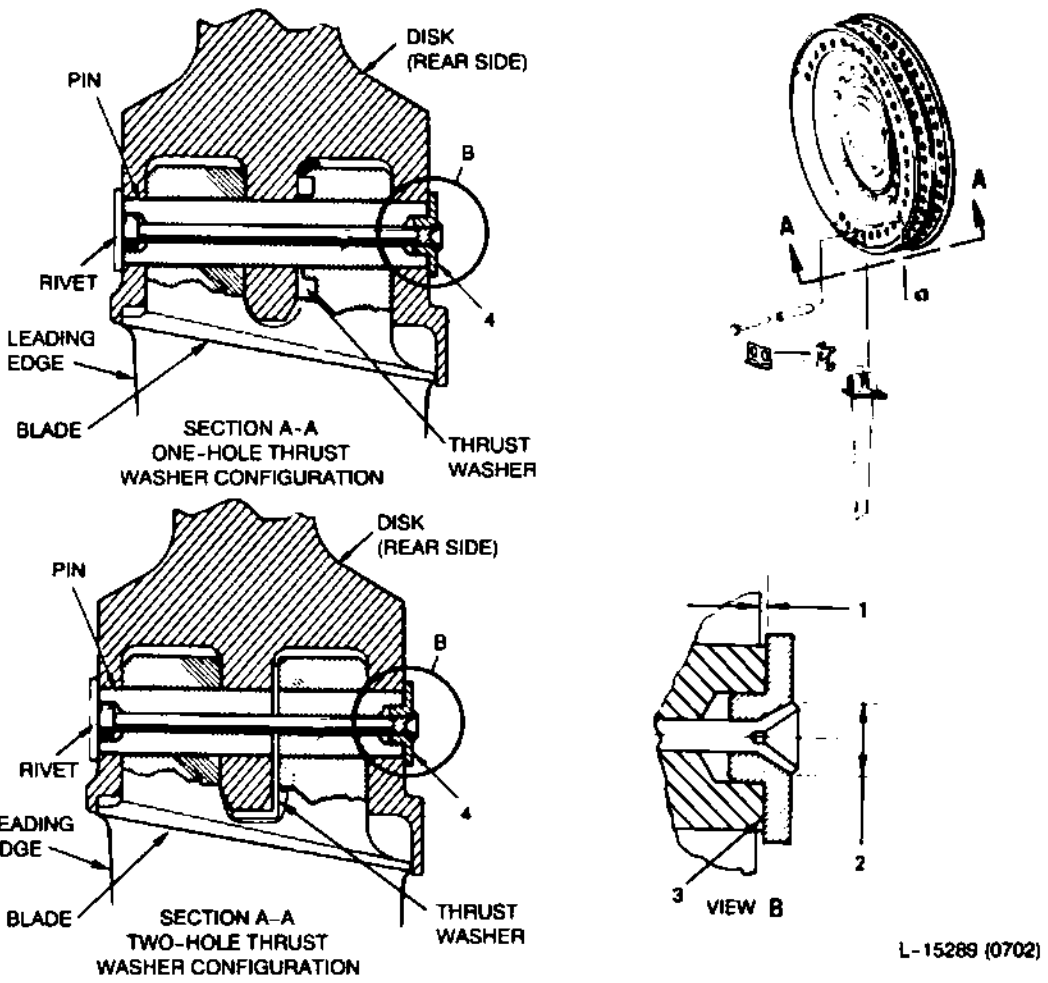
(d) Rivet head tightness (see figure).

Task 72-33-01-990-002:

4. Numerical Tool List

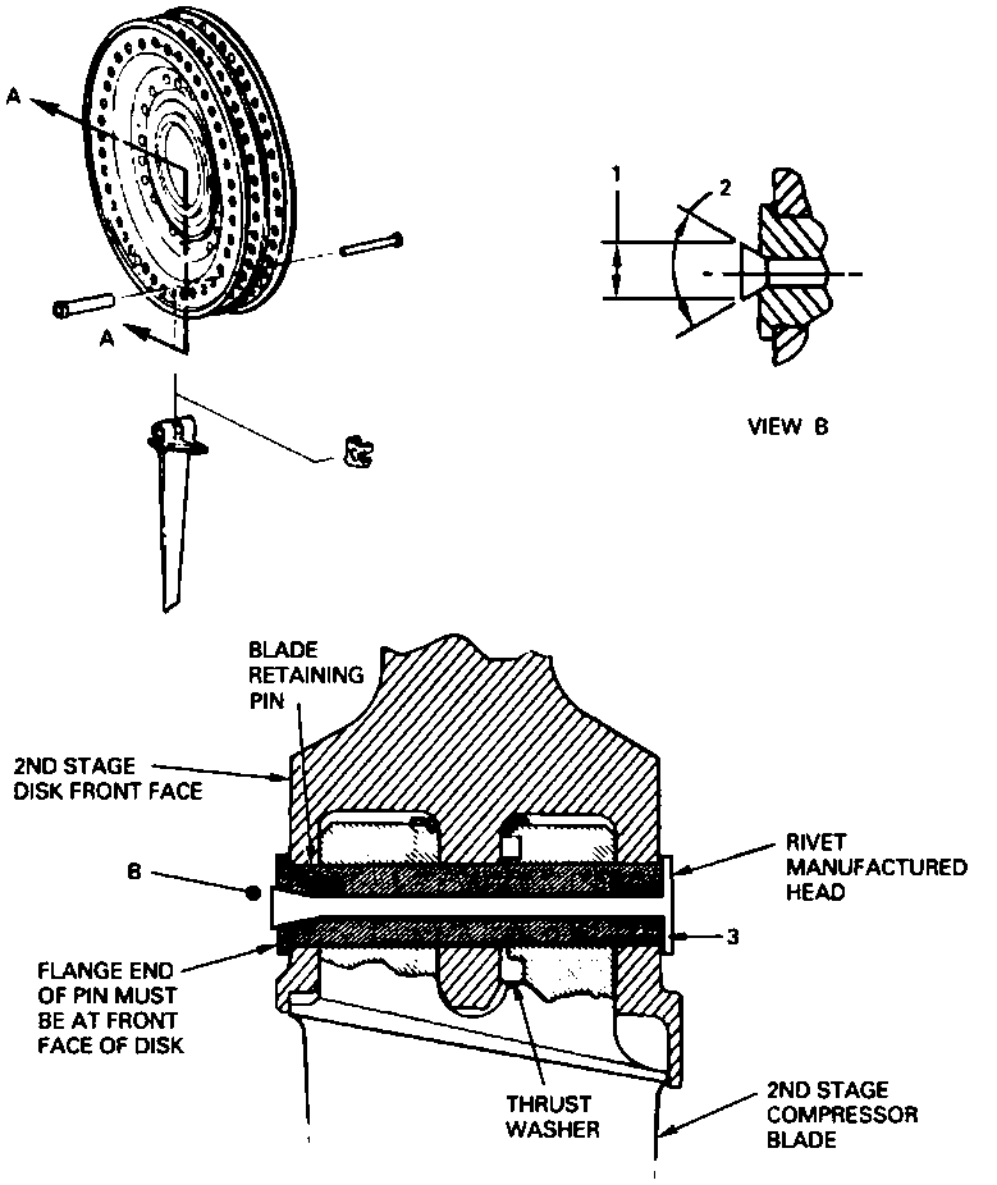
A. Numerical Tool List

PWA 12653 - Hand Riveter (Replaced by PWA 33533)
PWA 12654 - Riveter Base (JT8D-1,-1A,-1B,-7,-7A,-7B Engines)
PWA 32159 - Riveter Base - JT8D-9,-9A,-11,-15,-15A,-17,-17A, -17R,-17AR Engines.
PWA 33473 - Riveter Anvil
PWA 33498 - Riveter Base (JT8D-1,-1A,-1B,-7,-7A,-7B Engines)
PWA 33533 - Hand Riveter (Replaces PWA 33533)



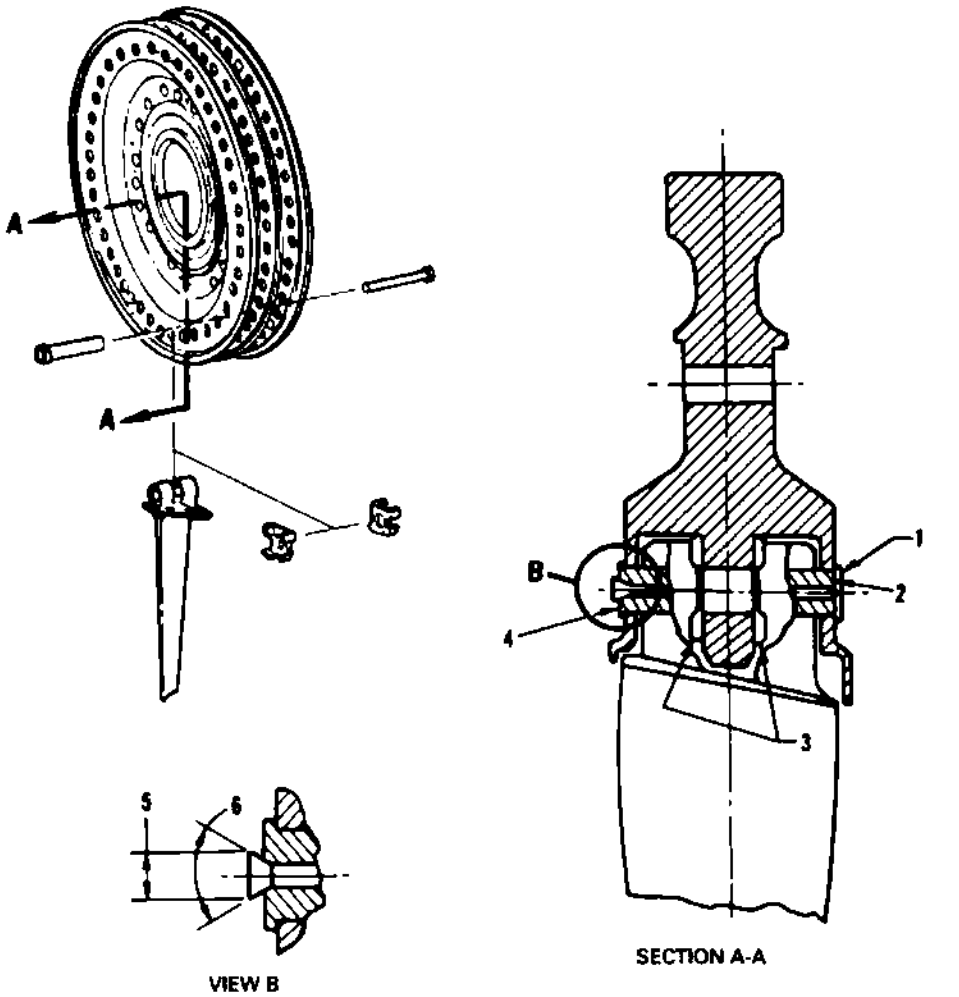
1. This Gap Must Not Vary More Than 0.005 Inch All Around Bushing
2. Flare To 0.160 Inch Minimum
3. Bushing Should Be Snug Against Pin. The Ability To Rotate The Bushing Or Pin Will Be Acceptable As Long As A 0.002 Inch Feeler Gage Cannot Be Inserted Between The Pin End And The Bushing.
4. Bushing - Pin (Not Reusable). Flared End Of Rivet Must Be Tight Against Bushing

JT8D-1,-1A,-1B,-7,-7A,-7B Rivet
Flaring (Single Thrust Washers)
Figure 201 (Sheet 1)
(Task 72-33-01-990-002)



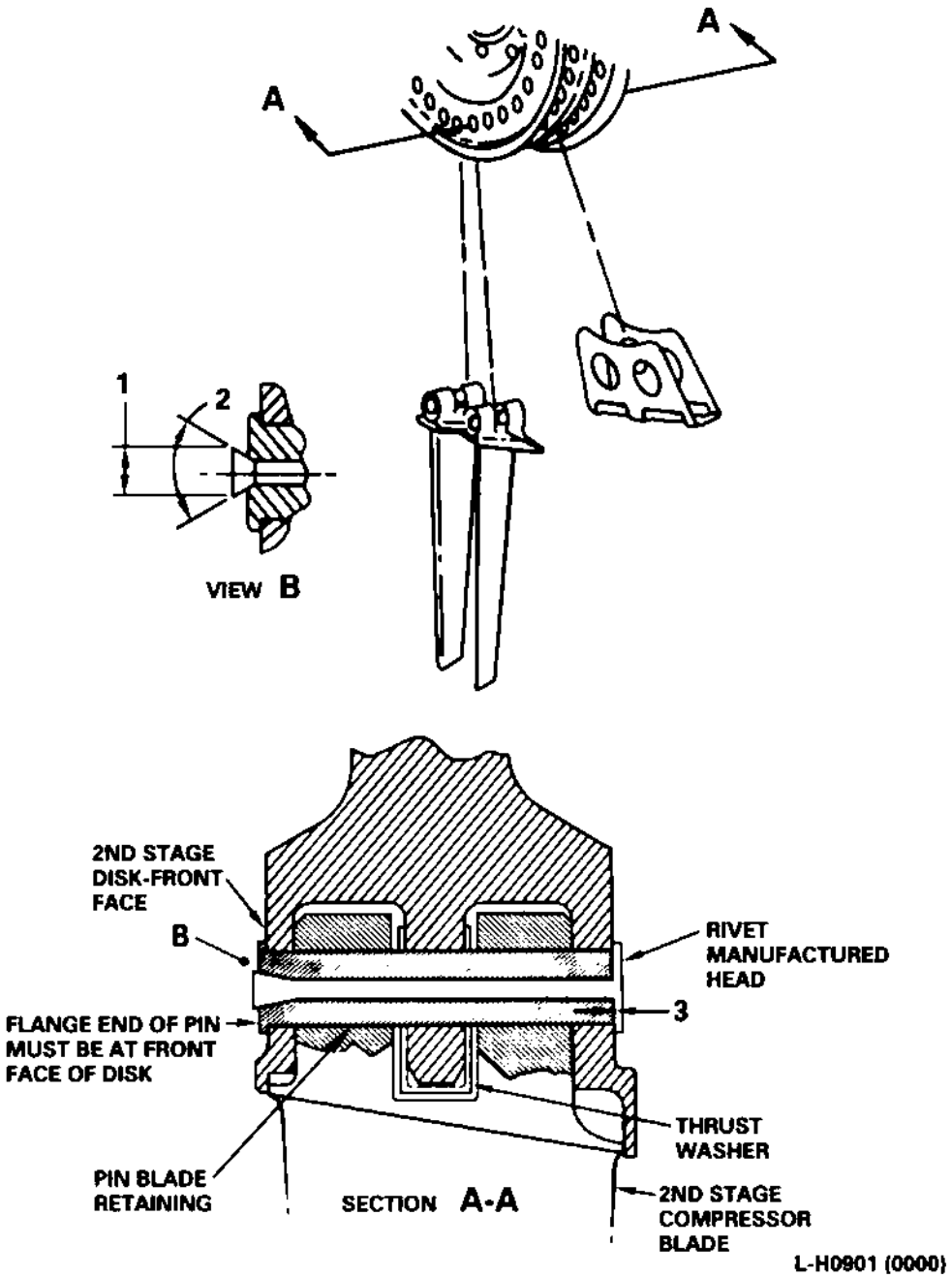
1. 0.161 Inch Minimum Flare Diameter
2. 60° (Reference)
3. Maximum Gap Of 0.003 Inch Permitted Between Rivet Head And Pin.

JT8D-9,-9A,-11,-15,-17 Rivet Flaring (Single Thrust Washers)
Figure 201 (Sheet 2)
(Task 72-33-01-990-002)



1. Rivet
2. 0.003 Inch Maximum Gap Permitted Between Rivet Head And Pin.
3. Thrust Washer (Two Required Per Blade).
4. Pin
5. 0.161 Inch Minimum Flare Diameter
6. 60° (Reference)

JT8D-9 Thru -17AR Rivet Flaring
(Double Thrust Washers)
Figure 201 (Sheet 3)
(Task 72-33-01-990-002)



1. 0.161 Inch Minimum Flare Diameter
2. 60° (Reference)
3. 0.003 Inch Maximum Gap Permitted Between Rivet Head And Pin.

JT8D-9 Thru -17AR Rivet
Flaring (Two-Hole Washers)
Figure 201 (Sheet 4)
(Task 72-33-01-990-002)

FRONT COMPRESSOR STATORS - DESCRIPTION-00

Task 72-33-50-990-001:

1. Front Compressor Stators

   A. There are six stages of stator vanes in the front compressor. Five of the stages are within the rotor and stator assembly. The sixth is in the front of the compressor (intermediate) case and is described with it. Stage 1 is titanium with an aluminum seal ring. Stages 2 and 3 are either aluminum with riveted vanes, or are steel with aluminum seal rings and steel strip stock vanes. (Most stage 2 and 3 steel strip stock vane stators incorporate silicone compound in the outer box shroud between the vanes.) Stages 4 and 5 are steel, with a box type outer shroud. All of stages 1 through 5 are continuous ring construction.

   B. The stators are designed to resist the torque loads transmitted by the aerodynamic forces along the vanes and to absorb the bending moments imposed by the pressure differentials across the vanes. The vanes decrease in size from front to rear and the angle at which they are mounted is set to feed air into the following row of rotor blades to give best compressor efficiency at operating speed.

Task 72-33-50-220-001:

1. First Stage Compressor Stator Vane Blending

A. Limits
See Figure 601.

(1) Total length of combined leading edge and trailing edge or leading edge and trailing edge blends singly, must not exceed 1.20 inches per vane.

(2) Not more than 2 repairs to the maximum depth limit are allowed per vane.

(3) Radial length of blend must be a minimum of one and one half to two times the depth of the nick (see figure).

(4) Blends to maximum depth on both leading and trailing edge must not be at the same radial station and must be radially separated by not less than the vane mean chordal length.

(5) Blends not to maximum depth limit on leading and trailing edge and within vane chordal length radial spacing, are acceptable only if combined blended depth does not exceed single blend nick limit given above.

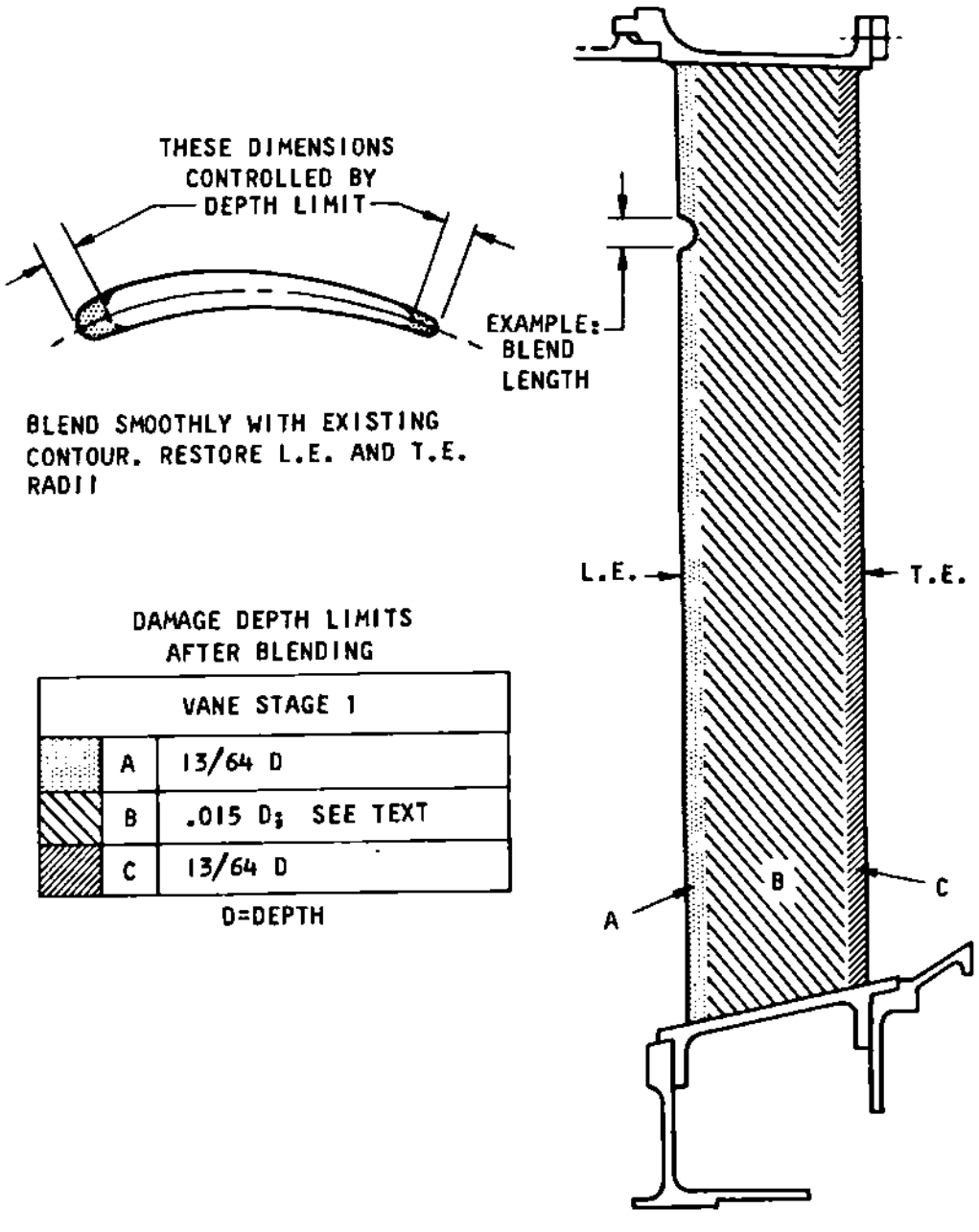
(6) A maximum of twenty inches total leading edge and/or trailing edge blend length rework is allowed in vane and shroud assembly.

(7) Damage or pitting to concave and convex sides of vanes (area B) must not exceed a maximum of 0.015 inch deep, for total repaired area not exceeding 10 percent of vane surface.

(8) All local blending concave and convex sides must exceed over an area at least fifteen times depth of injury.

(9) Surface finish on repaired vanes must be comparable to that of a new vane.

(10) Pitting and corrosion are not considered serious provided pitting does not exceed 0.005 inch in depth.



DAMAGE DEPTH LIMITS AFTER BLENDING

VANE STAGE 1		
	A	13/64 D
	B	.015 D; SEE TEXT
	C	13/64 D

D=DEPTH

1st Stage Compressor Stator
Vane Blending Limits
Figure 601
(Task 72-33-50-220-001)

Task 72-33-65-990-001:

1. Front and Rear Fan Cases

   A. Behind the inlet case, and enclosing the fan section, are the front and rear fan cases, of decreasing diameter from front to rear. Both cases are constructed of steel and the rear case has a shoulder at the front to accommodate the first stage vanes.

   B. Anti-rotation positioning pins in the flanges ensure correct positioning of the cases in the engine. The front case extends from Flange B to C and the rear case from Flange C to D.

   C. Post SB 5948, 5949, and 5950 engines have an acoustically treated fan case and liner assembly. This fan case and liner assembly is between the inlet case and front fan case.

Task 72-33-65-220-001:

1. Rear Fan Case - Inspection

See Figure 201.

A. Inspection Limits

(1) Inspect rear fan case for burn spots and/or scoring caused by blade rub or foreign object damage. Note particularly the amount of material which may have been removed by any rubbing.

(2) When total width of scored areas does not exceed 3/4 inch (approximately one-half of blade chord projected in the axial plane) interrupted scoring on ID is acceptable up to an accumulated length of 5 inches and to a depth of 0.050 inch.

(3) There is no limit to amount of scoring to a depth of 0.005 inch below minimum as-manufactured wall thickness as specified:

(a) JT8D-1,-1A,-1B,-7,-7A,-7B: PN 482471, 564846: 0.152 inch; PN 579093, 613782, 647564, 707471: 0.164 inch.

(b) JT8D-9,-9A,-11,-15,-17: PN 591857, 613783, 647821, 707472: 0.169 inch; JT8D-15A,-17A and -17AR: PN 5003444-01: 0.203 inch.

(c) JT8D-17R: 0.211 inch.

(4) Burn areas within limits and cases slightly out of round within limits may be continued in service if cleaned up on ID to remove titanium buildup. See Figure 201.

(5) Reject any case with wall thickness reduced more than 0.050 inch below minimum given in step (3).

(6) For JT8D-15A, -17A and -17AR, and cases incorporating SB 5371, inspect PWA 74-1 abradable rub strip on case ID. Cases may be continued in service within following limits.

NOTE: Excessive discontinuities in rub strip will decrease engine efficiency and performance.

(a) Inspect coating for wear caused by blade tip rub. Maximum tip clearance at stacking line of blade is 0.100 inch, except that this limit may be increased to 0.110 inch due to vane wake erosion. Either clearance limit is acceptable at single or multiple locations not exceeding ten percent of rub strip circumference.

(b) Nicks, gouges and FOD in rub strip less than 1.000 inch diameter, located at least 1.000 inch apart: not more than 20 in each rub strip.

(c) Nicks, gouges and FOD in rub strip up to 3.000 inch diameter maximum, located at least 5.000 inches apart: Not more than five in each rub strip.

(d) Inspect for loss of bond between coating and case parent metal by picking at suspect areas with pointed tool to try to dislodge coating material.

NOTE: Bond checks should be performed at interface of coating and parent metal where nicks, gouges or FOD extend down to parent metal, and particularly where rust color extends into coating.

1 If coating flakes off, bond is acceptable.

2 If coating comes off in chunks at the bond interface, bond is not acceptable.

(e) Case is not acceptable if wear or cavities in rub strip expose parent metal.

Task 72-33-65-300-001:

2. Rear Fan Case - Repair

A. Procedure

(1) Areas not within limits given in inspection (preceding paragraph), clean up ID of case to remove titanium buildup and ensure blade tip clearance.

CAUTION: DO NOT REMOVE MORE THAN 0.005 INCH OF PARENT METAL BELOW MINIMUM AS-MANUFACTURED WALL THICKNESS SPECIFIED IN TASK 72-33-65-220-001.

(2) Blend affected area smooth to adjacent non-affected area with hand stone.

(3) Repair individual acceptable nicks, gouges and FOD in rub strip by blending and removing all sharp edges.

Task 72-33-65-220-002:

3. Front Fan Case - Inspection

See Figure 202.

A. Inspection Limits

(1) Inspect front fan case for burn spots and/or scoring due to blade rub or foreign object damage. Note particularly the amount of material which may have been reworked by any rubbing.

(2) Interrupted scoring on ID is acceptable to an accumulated length of five inches and to a maximum depth of 0.050 inch below minimum wall thickness so long as total width of scored area does not exceed 3/4 inch (approximately one-half of blade chord projection in axial plane). Minimum as-manufactured wall thickness is as follows:

(a) (JT8D-1,-1A,-1B,-7,-7A,-7B) PN 489045, 564845: 0.190 inch; PN 579095, 714048, 727697, 765276, 785820: 0.202 inch; PN 5005394-02, 808233: 0.244 inch.

(b) (JT8D-9,-9A,-11,-15,-15A,-17,-17A) PN 591853, 717074, 727696, 765274, 780530, 790531, 790531-001, 790736, 790740, 790741: 0.209 inch; PN 790746, 790747, 5003446-01, 5003446-02: 0.250 inch; PN 808010: 0.259 inch.

(c) JT8D-17R,-17AR: 0.259 inch.

(3) There is no limit to amount of scoring to a depth of 0.005 inch below minimum wall thickness.

(4) Burn areas within limits and cases slightly out-of-round within limits may be continued in service if cleaned up on ID to remove titanium buildup. See applicable sheet of Figure 202.

(5) Reject any case with wall thickness reduced more than 0.050 inch below minimum given in step (2).

(6) For JT8D-15A, -17A and -17AR, and cases incorporating SB 5371 and case PN 808009, inspect PWA 74-1 abradable rub strip on case ID. Cases may be continued in service within following limits.

NOTE: Excessive discontinuities in rub strip will decrease engine efficiency and performance.

(a) Inspect coating for wear caused by blade tip rub. Maximum tip clearance at stacking line of blade is 0.113 inch, except that this limit may be increased to 0.123 inch due to vane wake erosion. Either clearance limit is acceptable at single or multiple locations not exceeding ten percent of rub strip circumference.

(b) Nicks, gouges and FOD in rub strip less than 1.000 inch diameter, located at least 1.000 inch apart: not more than 20 in each rub strip.

(c) Nicks, gouges and FOD in rub strip up to 3.000 inch diameter maximum, located at least 5.000 inches apart: Not more than five in each rub strip.

(d) Inspect for loss of bond between coating and case parent metal by picking at suspect areas with pointed tool to try to dislodge coating material.

NOTE: Bond checks should be performed at interface of coating and parent metal where nicks, gouges or FOD extend down to parent metal, and particularly where rust color extends into coating.

1 If coating flakes off, bond is acceptable.

2 If coating comes off in chunks at the bond interface, bond is not acceptable.

(e) Case is not acceptable if wear or cavities in rub strip expose parent metal.

Task 72-33-65-300-002:

4. Fan Case And Liner Assembly

NOTE: This case is found between the inlet and front fan cases in engines with the re-spaced inlet modification (SB 5948, 5949, or 5950). See Figure 203 for case features.

A. Sound Absorbing Liner Inspection

(1) Examine sound absorbing liners for disbonds (delaminations).

(a) Disbonds, or an outer skin of liner segment loose against the duct wall, are not permitted.

(b) Local areas of disbond of the inner perforated sheet which are not more than one square inch in area at a location are permitted in a liner segment, one per segment. The minimum distance of the disbond from the front edge of a liner segment is one inch.

(c) A sound absorbing liner inner face sheet which is lifted up at the edge is not permitted.

(d) If a bonded surface is discolored by heat, examine the liner for disbonds.

(e) Tap the liner surface with a coin to make a bond test. If there is a change in the pitch of the sound made from one area to another, this can show possible disbonds or delaminations.

(2) All dents, nicks, scratches, and scrapes in the inner perforated face sheet that do not go through the skin or compress the honeycomb are permitted.

(3) Punctures or tears in the inner perforated face sheet are permitted up to one square inch (this includes compressed or missing honeycomb cells) if the outer face sheet or duct wall is not damaged.

(a) No more than one square inch of damage which is not repaired is permitted per liner segment. Remove all lifted material. No lifted edges of the perforated sheet are permitted.

R
R

(b) Remove disbonded honeycomb cells in the area of punctures and tears.

(c) One crack per liner segment up to one inch long, and one inch minimum from the forward edge of the liner segment is permitted, if the perforated sheet at the edge of the crack is not lifted.

(d) If damage is less than the limits for repair, examine it again at 500 hour intervals.

(e) For damage which is more than the above limits, refer to the Flyback Limits in step (5).

(4) Do a visual inspection for cracks on all bonded assemblies.

(5) FlyBack Limits

(a) Sound absorbing liners with damage to the inner perforated sheet (see below) can continue in service for ten (10) hours before repairs will be necessary. Limits for this damage are:

1 One crack per liner segment up to two inches long, if the perforated sheet is not lifted at the edges of the crack.

2 One puncture, tear, or disbond per liner segment up to three inches long each. Remove all lifted material. No lifted edges of the perforated sheet are permitted.

3 No damage is permitted on the outer skin or duct wall.

(6) Repair Procedures

(a) Repair damage which is more than the above limits by Paragraphs B thru D.

B. Sound Absorbing Liner Minor Damage Repair
See Figure 204
and Table 201.

(1) It is permitted to use PWA 603 potting compound to repair damage as follows, but the total repair area must not be more than the limits shown in the table.

R

Circumference Area Of Damage in Degrees	Permitted Repair Area In Square Inches
10°	5
30°	10
180°	40
360°	60

Sound Liner Damage Limits
Table 201

(a) Disbonds, each up to 5.0 square inches found by "tap test" inspection.

(b) Dents, nicks or scratches more than the given limits in face sheets or duct walls.

NOTE: If a liner shows damage more than the limits specified, give it a "tap test" to find how large the disbond area is. Refer to Paragraph A.

WARNING: SOME SOLVENTS CAN BE DANGEROUS. BE SURE TO USE THE CORRECT PROTECTIVE CLOTHING (PLASTIC GLOVES OVER COTTON GLOVES) WHEN YOU USE THESE SOLVENTS. REFER TO THE MANUFACTURER/ SUPPLIER'S MATERIAL SAFETY DATA SHEET FOR INSTRUCTIONS ON HOW TO USE THESE MATERIALS SAFELY.

R (2) Flush the repair area with SPOP 208 solvent. Refer
R to (Task 70-00-00-100-004) in 70-00-00, Standard
R Practices. Be sure to drain out all liquid solvent. There must be no dirt, oil, grease or other unwanted materials on the case.

(3) Wipe the outer repair area with a clean, unsized cheesecloth.

NOTE: Sized cheesecloth contains resin binders which can dissolve in solvents and cause contamination of the bond surface. Solvent dispensers must be the squirt or pour type to prevent contamination from work cloths.

WARNING: THERE CAN BE FIRE DANGER WITH SOME SOLVENTS. DO NOT USE A HEAT GUN UNTIL AFTER THE CASE IS DRY.

CAUTION: DO NOT LET THE PERFORATED LINER SKIN GET TO MORE THAN A MAXIMUM TEMPERATURE OF 220°F (104.4°C) (TOO HIGH A TEMPERATURE CAN DAMAGE THIS MATERIAL).

(4) Dry for at least 15 minutes. Then fully dry the repair area with a heat gun at 220°F (104.4°C) maximum or in an oven at 100° - 150°F (38° - 66°C) for 30 minutes. Use thermal couples of similar size to the Tempilabel tabs that were previously used to make sure that the surface temperature does not go too high.

(5) Apply PWA 603 Potting Compound as follows:

(a) Prepare PWA 603 Compound by the manufacturer's instructions.

NOTE: PWA 603 is available as Eccobond SF-40 from Emerson & Cuming, Inc. (Division of W.R. Grace & Co.), Grace Syntactics, 59 Walpole Street, Canton, MA 02021 USA.

(b) Where there is access to the honeycomb cells, apply the compound with a spatula.

(c) When there is less access to the disbond areas, use pressure injection to apply the compound. Make sure injected compound comes out of adjacent perforation holes and is made smooth in the form of a 0.025 inch crown over all of the disbond or damage area as shown in the figure.

NOTE: It is permitted to have one perforation in a honeycomb cell made up to 0.100 inch diameter if necessary for injection.

(d) Cure the compound for one hour at 60° - 100°F (16° - 38°C), followed by two hours minimum at 180° - 220°F (82° - 104°C).

R
R

(e) After the compound is cured, use sandpaper to put a smooth, continuous contour on the potting compound area near the adjacent surface. Remove dust with a vacuum cleaner.

NOTE: Adjacent perforated sheet areas with no damage must have protection to keep grit and dust out of cells not repaired.

(6) Examine the repair area for disbonds and repair all disbonds found.

C. Sound Absorbing Liner Repair (Damaged Perforated Sheet But Honeycomb Intact)

(1) It is permitted to repair liners with perforated sheet damage up to four inches in diameter at each location, but with honeycomb intact, if the total damage is not more than the limits in Table 201 (refer to Paragraph B).

NOTE: If the honeycomb is also damaged, repair by Paragraph D.

(2) Use a fine-tooth hole-type cutter to cut out only the damaged perforated sheet. Keep the depth of the cut to a minimum.

(3) Make the walls of damaged cells straight. Cut out material that extends into the flowpath, but do not remove good cell material that will make the epoxy repair stronger.

WARNING: SOME SOLVENTS CAN BE DANGEROUS. BE SURE TO USE THE CORRECT PROTECTIVE CLOTHING (PLASTIC GLOVES OVER COTTON GLOVES) WHEN YOU USE THESE SOLVENTS. REFER TO THE MANUFACTURER/SUPPLIER'S MATERIAL SAFETY DATA SHEET FOR INSTRUCTIONS ON HOW TO USE THESE MATERIALS SAFELY.

(4) Flush the repair area with SPOP 208 solvent (Task 70-00-00-100-004) in 70-00-00 in the Standard Practices. Be sure to drain out all liquid solvent. There must be no dirt, oil, grease or other unwanted materials on the case.

(5) Wipe the outer repair area with clean, unsized cheesecloth.

NOTE: Sized cheesecloth contains resin binders which can dissolve in solvents and cause contamination of the bond surface. Solvent dispensers must be the squirt or pour type to prevent contamination from work cloths.

WARNING: THERE CAN BE FIRE DANGER WITH SOME SOLVENTS. DO NOT USE A HEAT GUN UNTIL AFTER THE CASE IS DRY.

CAUTION: DO NOT LET THE PERFORATED LINER SKIN GET TO MORE THAN A MAXIMUM TEMPERATURE OF 220°F (104.4°C) (TOO HIGH A TEMPERATURE CAN DAMAGE THIS MATERIAL).

(6) Dry for 15 minutes or more. Then fully dry the repair area with a heat gun at 220°F (104.4°C) maximum or in an oven at 100° - 150°F (38° - 66°C) for 30 minutes. It is recommended that Tempilabel Tabs (available from Omega Engineering, Inc., P.O. Box 4047, Stamford, CT 06907), or equivalent, be used to make sure that the surface temperature does not go too high.

(7) Where the perforated sheet is gone, fill all open honeycomb cells with PWA 457 Epoxy Adhesive Compound. Use a trowel to make this material flush with the adjacent surface. If adhesive flows out of the repair area, hold it in position with a dam of material which has the same contour as the case.

NOTE: Make sure the dam material has a thin face of film which will be make the material easy to remove after the adhesive is cured.

NOTE: PWA 457 Adhesive is available as EA 9396 (adhesive paste) or EA 934 NA from Dexter Hysol Aerospace Inc., Dexter Corp., 211 Franklin Street, Orlean, NY 14760 USA.

(8) Cure the compound for one and one-half hours at 240° - 260°F (115.6° - 126.7°C) or at ambient temperature for seven days.

R
R

(9) After the adhesive is cured, use sandpaper to put a smooth, continuous contour on the potting compound near the adjacent surfaces.

NOTE: Adjacent perforated sheet areas with no damage must have protection to keep grit and dust out of cells not repaired.

(10) Examine the repair area for disbonds and repair all disbonds found.

D. Sound Absorbing Liner Repair (For Damage To Perforated Sheet And Honeycomb)
See Figure 205.

(1) It is permitted to repair liners with perforated sheet damage up to 4.0 inches in diameter at each location, and with damage to honeycomb, as follows if the total
R repair area is not more than the limits shown in Table
R 201 (refer to Paragraph B). If a repair hole size is
R more than 4.0 inches diameter, or all the repairs
R together are more than the limits in Table 201 (refer
R to Paragraph B), it will be necessary to replace the liner.

(2) Use a fine-tooth hole-type cutter to cut out damaged perforated sheet. Keep the depth of the cut to a minimum.

(3) Use a router or electric drill with a router bit to cut out damaged honeycomb. Be careful not to cut or make nicks in other surfaces. See Figure 205.

WARNING: SOME SOLVENTS CAN BE DANGEROUS. BE SURE TO USE THE CORRECT PROTECTIVE CLOTHING (PLASTIC GLOVES OVER COTTON GLOVES) WHEN YOU USE THESE SOLVENTS. REFER TO THE MANUFACTURER/ SUPPLIER'S MATERIAL SAFETY DATA SHEET FOR INSTRUCTIONS ON HOW TO USE THESE MATERIALS SAFELY.

R (4) Flush the repair area with SPOP 208 solvent (Task
R 70-00-00-100-004). Refer to 70-00-00, Standard
R Practices. Be sure to drain out all liquid solvent. There must be no dirt, oil, grease or other unwanted materials on the case.

(5) Wipe the outer repair area with clean, unsized cheesecloth.

NOTE: Sized cheesecloth contains resin binders which can dissolve in solvents and cause contamination of the bond surface. Solvent dispensers must be the squirt or pour type to prevent contamination from work cloths.

WARNING: THERE CAN BE FIRE DANGER WITH SOME SOLVENTS. DO NOT USE A HEAT GUN UNTIL AFTER THE CASE IS DRY.

CAUTION: DO NOT LET THE PERFORATED LINER SKIN GET TO MORE THAN A MAXIMUM TEMPERATURE OF 220°F (104.4°C) (TOO HIGH A TEMPERATURE CAN DAMAGE THIS MATERIAL).

(6) Dry for 15 minutes or more. Then fully dry the repair area with a heat gun at 220°F (104.4°C) maximum or in an oven at 100° - 150°F (38° - 66°C) for 30 minutes. It is recommended that Tempilabel Tabs (available from Omega Engineering, Inc., P.O. Box 4047, Stamford, CT 06907), or equivalent, be used to make sure that the surface temperature does not go too high.

(7) From a newly purchased liner segment assembly, PN 808005-01, cut a replacement section to restore/fill the existing case liner's hole. Place cut liner section into existing case liner hole.

(8) Put a bevel surface around the replaced core on both sides as shown.

(9) Install a temporary block or mold and shim backing and fill all honeycomb cells where the perforated face sheet is gone with PWA 457 Epoxy Adhesive Compound. Use a trowel to make the adhesive flush to a small distance above the adjacent surface.

NOTE: Make sure the backing shim material has the same contour as the liner and has a thin film face which will make the material easy to remove after the adhesive is cured.

NOTE: PWA 457 Adhesive is available as EA 9396 (adhesive paste) or EA 934 NA from Dexter Hysol Aerospace Inc., Dexter Corp., 211 Franklin Street, Orlean, NY 14760 USA.

R
R

(10) Remove the block or mold and temporary shim backing. With a trowel carefully fill the open cells where the perforated sheet is gone on this side until the adhesive is flush to a small distance higher than the adjacent surface as shown.

(11) Cure the compound for one and one-half hours at 240° - 260°F (115.6° - 126.7°C) or at ambient temperature for seven days.

(12) After the adhesive is cured, use sandpaper to put a smooth, continuous contour on the repair area near the adjacent surfaces.

NOTE: Adjacent perforated sheet areas with no damage must have protection to keep grit and dust out of the cells not repaired.

(13) Examine the repaired area for disbonds and repair all remaining disbond areas.

Task 72-33-65-300-003:

5. Front Fan Case - Repair

A. Procedure

(1) Repair individual acceptable nicks, gouges and FOD in rub strip by blending and removing all sharp edges.

(2) For JT8D-15A,-17A and -17AR and cases incorporating SB 5371 and case PN 808009, repair minor damage to PWA 74-1 coating as follows:

R (a) Clean damaged area by SPOP 208 (Task
R 70-00-00-100-004) to remove any previously applied
R enamel or other contaminants. Refer to 70-00-00,
R Standard Practices.

(b) Using masking tape, mask areas not to be painted.

(c) Prepare PWA 568 Epoxy Primer and PWA 569 Aluminized Epoxy Enamel by SPOP 148. See the Standard Practices Manual, Section 70-41-03.

NOTE: Working life of each mixture is approximately eight hours at room temperature. Each primer mixture should be identified as to time and date of mixing. Obtain primer and enamel from DeSoto, Inc.,

Forest Lane and Shiloh Road, P.O. Box 10, Garland, TX 75040 U.S.A.

1 PWA 568 epoxy primer: mix three parts by volume of Primer Base 519 x 303 with one part by volume of Curing Solution 910-357 and two parts by volume of Solvent 020 x 324 and stir well.

2 PWA 569 aluminized epoxy enamel: mix one part by volume of aluminized epoxy enamel base 529-300 with one part by volume of curing solution 910-465. Mixture must digest for one hour before use.

NOTE: Mixture may be thinned to proper consistency if necessary using DeSoto 020-324 solvent reducer.

(d) Apply one coat of epoxy primer mixture to damaged case area and air dry for one hour minimum.

(e) Apply one coat of aluminized epoxy enamel mixture.

(f) Bake enamel with heat gun at 160° ± 20°F (71° ± 11°C) for one hour.

NOTE: Air dry at room temperature for minimum of 24 hours if desired as substitute for heat application.

(g) Remove masking and check for complete coverage. Recoat as necessary.

Task 72-33-65-220-003:

6. Fan Discharge (Exit) Case - Inspection

A. Vane-To-Shroud Braze Joint Crack Limits

(1) Cracks in braze joints which join vanes to inner and/or outer shrouds are acceptable provided:

(a) Aggregate length of cracks does not exceed 0.500 inch.

(b) Cracks do not extend into parent metal of vane or shroud.

B. Inspection For Missing Fan Exit Guide Vanes

R
R

(1) Check outer shroud for missing vanes.

(2) Where possible use flashlight to look forward from tailpipe for missing vanes.

(3) If there are one or more missing vanes, replace the case.

C. Inspection for cracked mount flange bolt holes.

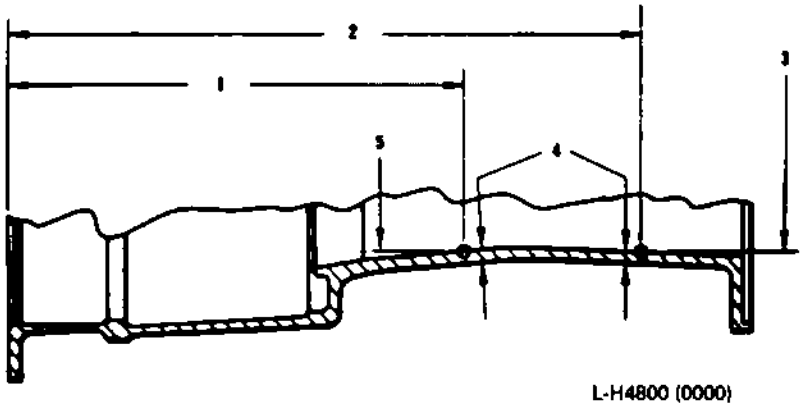
(1) Do a visual inspection of the front and rear mount flanges for radial cracks in the bolt holes.

(2) A single cracked bolt hole, in each mount flange, is permitted for continued service, without repair, provided:

(a) The crack is in a radial direction from the bolt hole to the outer diameter of the flange.

(3) Cases must be removed from service that have bolt hole cracks that go radially inboard from the hole.

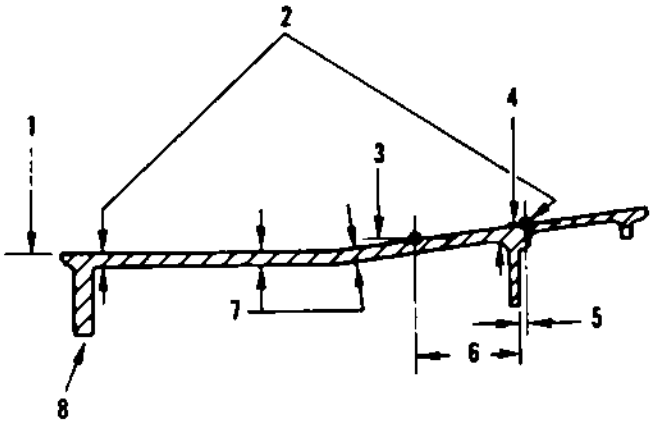
(4) Cases with acceptable bolt hole cracks, as specified above, must be inspected again at each scheduled aircraft check.



L-H4800 (0000)

1. JT8D-1,-1A,-1B,-7,-7A,-7B: 5.714 Inch (Gage Point)
   JT8D-9,-9A,-11,-15,-17,-17R: 5.119 Inch (Gage Point)
2. JT8D-1,-1A,-1B,-7,-7A,-7B: 7.880 Inch (Gage Point)
   JT8D-9,-9A,-11,-15,-17,-17R: 7.932 Inch (Gage Point)
3. JT8D-1,-1A,-1B,-7,-7A,-7B: 38.755 - 38.775 Inch Diameter
   May Be Blended To 38.745 - 38.775 Inch Diameter When Removing Buildup.
   JT8D-9,-9A,-11,-15,-17,-17R: 38.676 - 38.686 Inch Diameter.
   May Be Blended To 38.666 - 38.686 Inch Diameter When Removing Buildup.
4. JT8D-1,-1A,-1B,-7,-7A,-7B: PN 482471, 564846: 0.147 Inch Minimum*; PN 579093, 613782, 647564, 707471: 0.159 Inch Minimum*
   JT8D-9,-9A,-11,-15,-17 PN 591857, 613783, 647821, 707472: 0.164 Inch Minimum*; JT8D-15A,-17A and -17AR: PN 5003444-01: 0.198 Inch Minimum*
   JT8D-17R: 0.206 Inch Minimum*
5. JT8D-1,-1A,-1B,-7,-7A,-7B: 38.755 - 38.775 Inch Diameter
   May Be Blended To 38.745 - 38.775 Inch Diameter When Removing Buildup.
   JT8D-9,-9A,-11,-15,-17,-17R: 38.727 - 38.737 Inch Diameter
   May Be Blended To 38.717 - 38.737 Inch Diameter When Removing Buildup.
   *0.005 Inch Below Minimum As-Manufactured Wall Thickness (See Text)

R Rear Fan Case
R Figure 201
(Task 72-33-65-220-003)

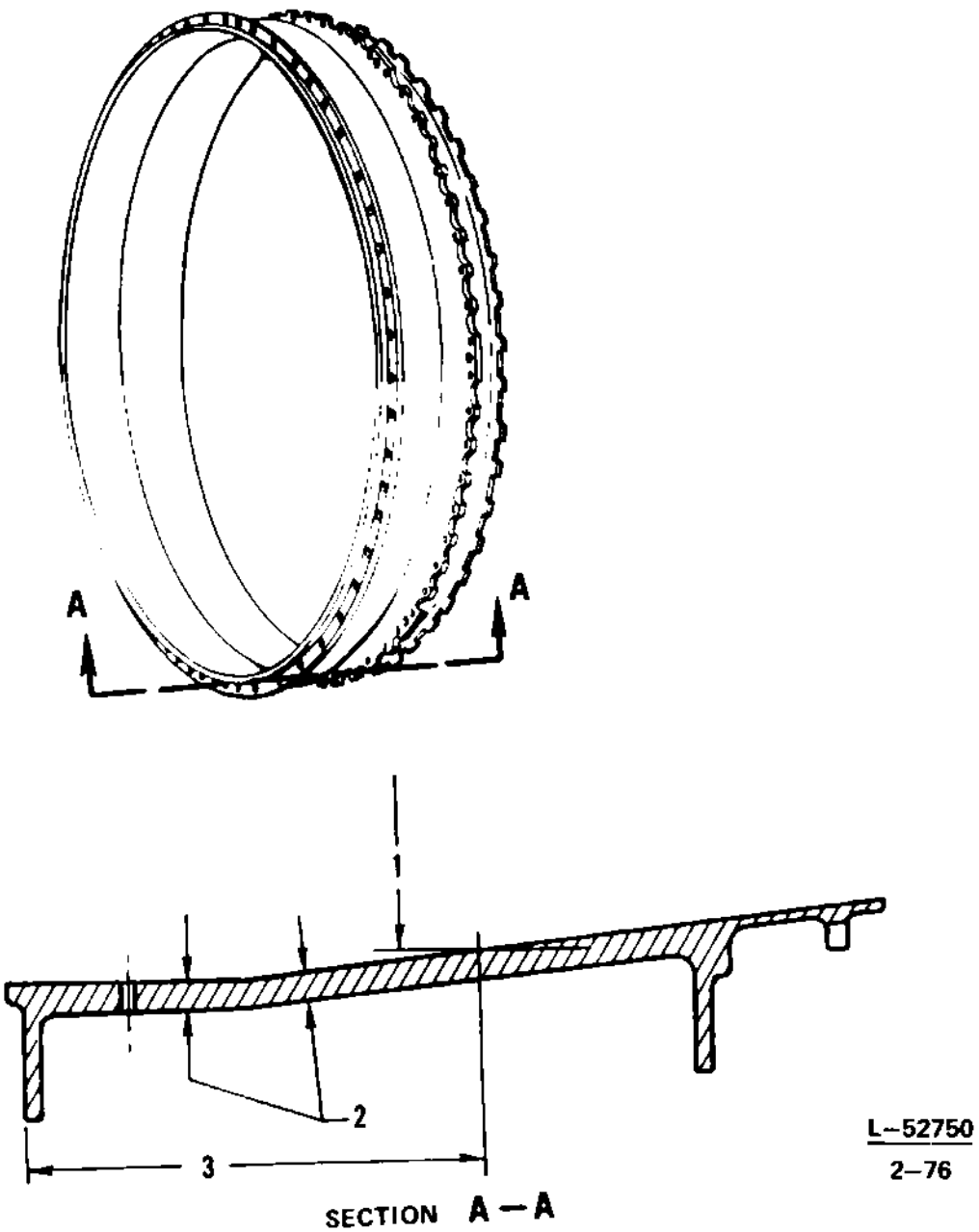


L-18736

1. 40.495 - 40.505 Inch Diameter
2. No Scoring More Than 0.050 Inch Below Minimum In This Area
3. 40.268 - 40.278 Inch Diameter
4. 39.941 - 39.951 Inch Diameter
5. 0.116 Inch
6. 1.168 Inches
7. PN 489045, 564845 And 734663: 0.185 Inch Minimum*. PN 579095, 714048, 727697, 734976, And 765276: 0.197 Inch Minimum*
8. Front Flange

*0.005 Inch Below Minimum As-Manufactured Wall Thickness (See Text)

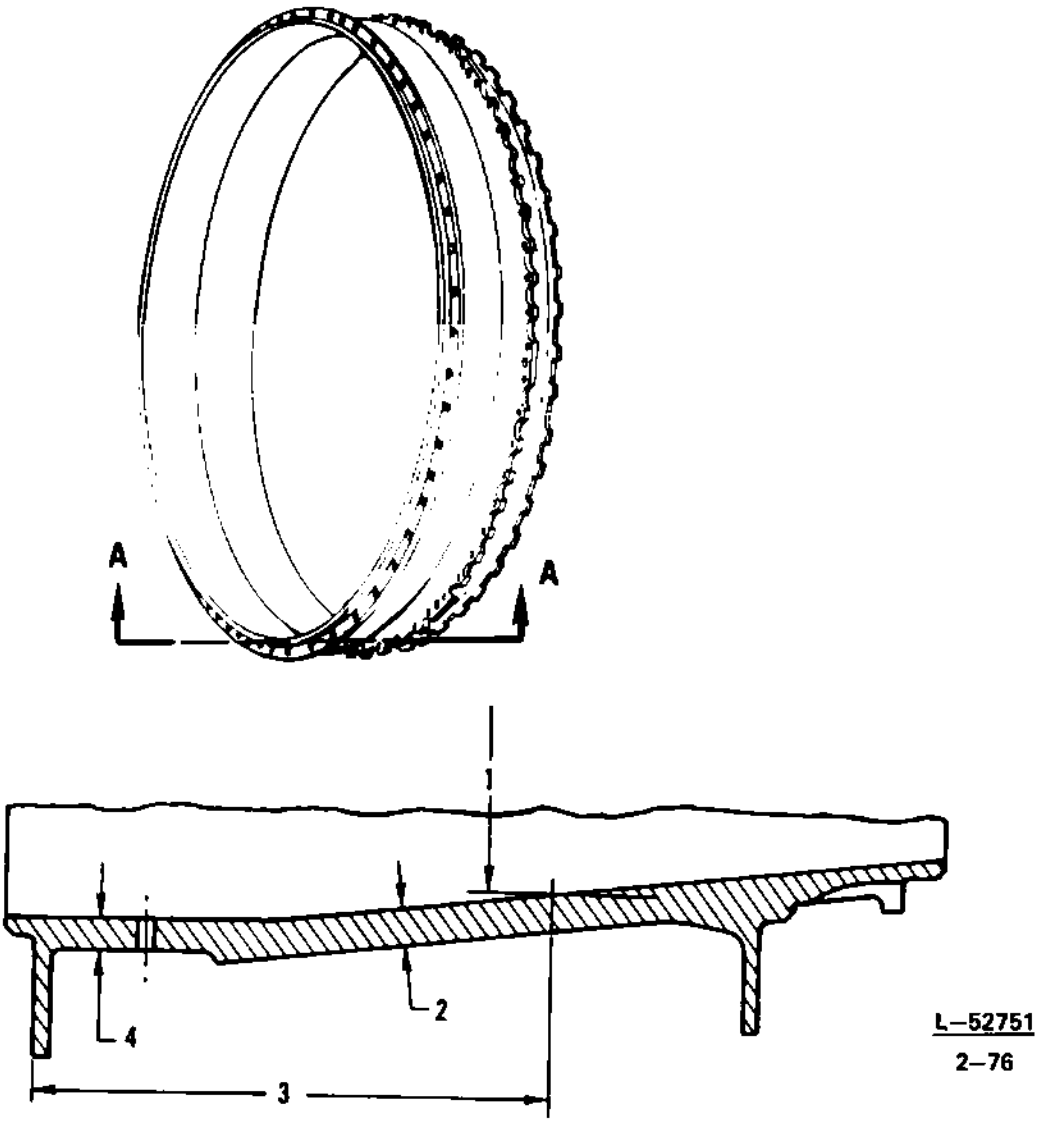
Front Fan Case
(JT8D-1,-1A,-1B,-7,-7A,-7B)
Figure 202 (Sheet 1)
(Task 72-33-65-220-003)



SECTION A-A

1. 40.138 - 40.148 Inch Diameter
2. 0.204 Inch Minimum For PN 591853, 714074, 727696, 765274, 785030, 790531, 790531-001, 790736, 790740, And 790741; 0.245 Inch Minimum For PN 5003446-01, 5003446-02, 790746, And 790747. (0.005 Inch Below Minimum As Manufactured Wall Thickness - See Text)
3. 3.253 Inches (Gage Point)

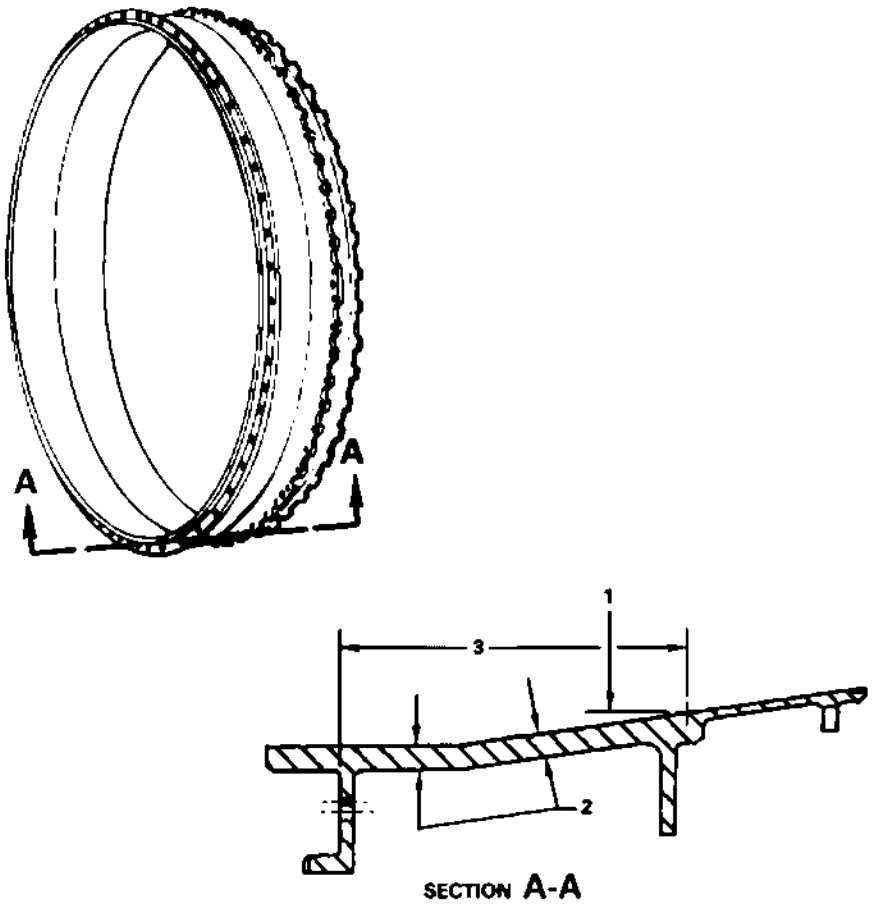
Front Fan Case
(JT8D-9,-9A,-11,-15,-15A,-17,-17A)
Figure 202 (Sheet 2)
(Task 72-33-65-220-003)



SECTION A-A

1. 40.138 - 40.148 Inch Diameter
2. 0.254 Inch Minimum Wall Thickness (0.005 Inch Below Minimum As-Manufactured Wall Thickness - See Text)
3. 3.253 Inches (Gage Point)
4. 0.204 Inch Minimum Wall Thickness

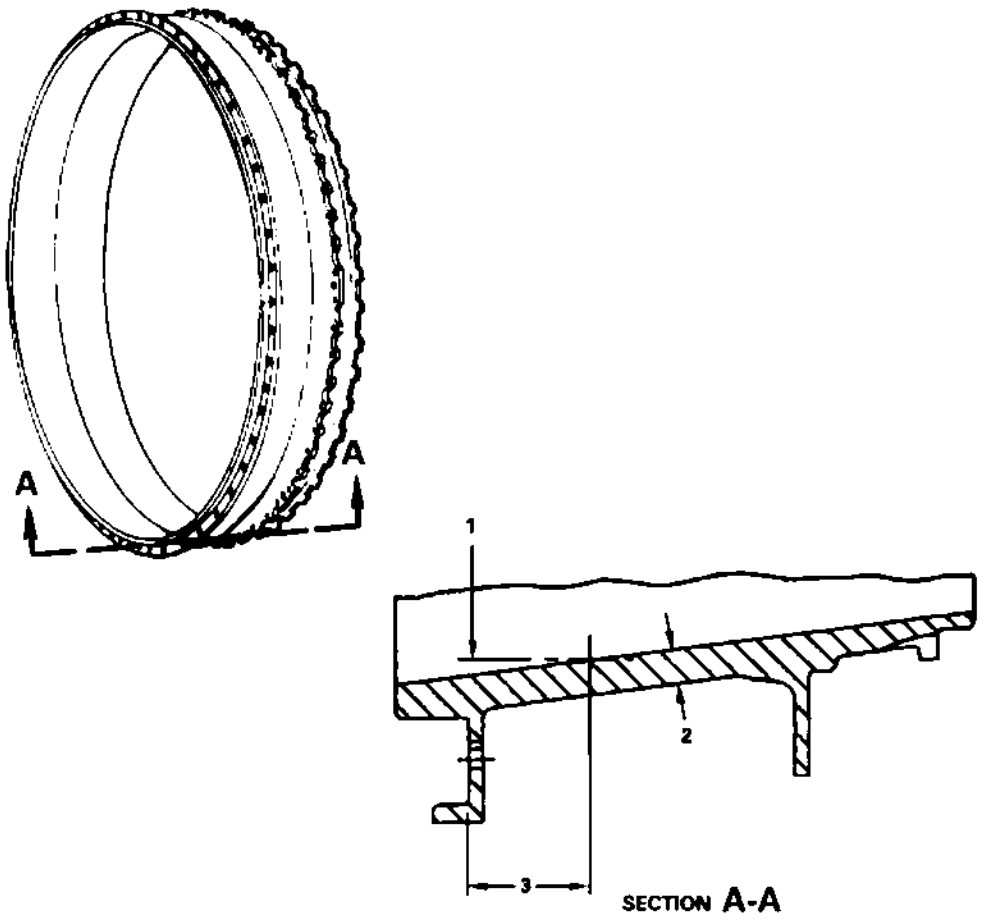
Front Fan Case (JT8D-17R,-17AR)
Figure 202 (Sheet 3)
(Task 72-33-65-220-003)



L-H1941 (0000)

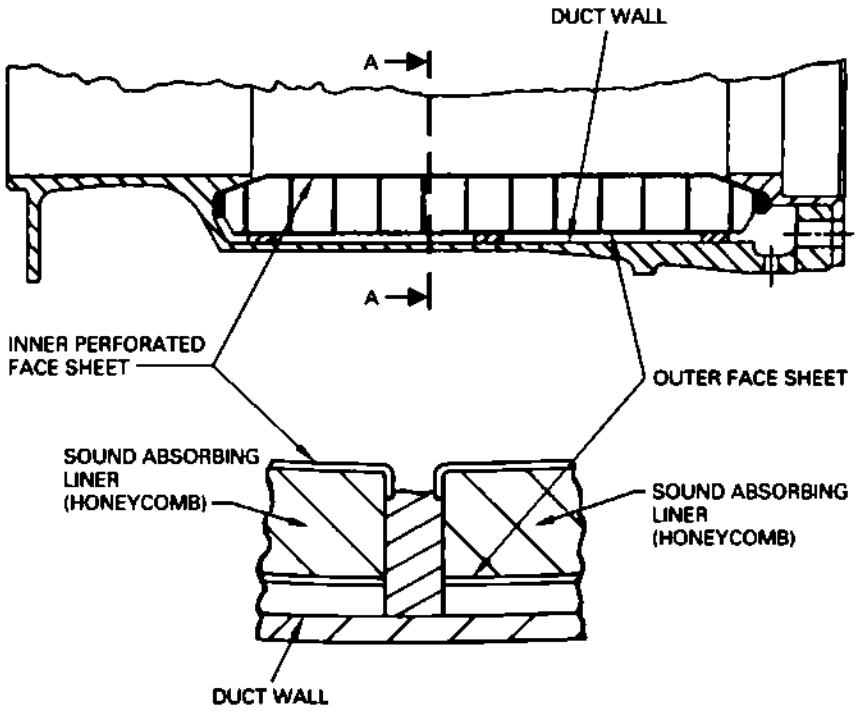
1. 39.941 - 39.951 Inch Diameter
2. 0.239 Inch Minimum Wall Thickness For PN 808230 (0.005 Inch Below Minimum As-Manufactured Wall Thickness - See Text)
3. 2.667 Inches (Gage Point)

Front Fan Case
(JT8D-7,-7A,-7B Post SB 5948)
Figure 202 (Sheet 4)
(Task 72-33-65-220-003)

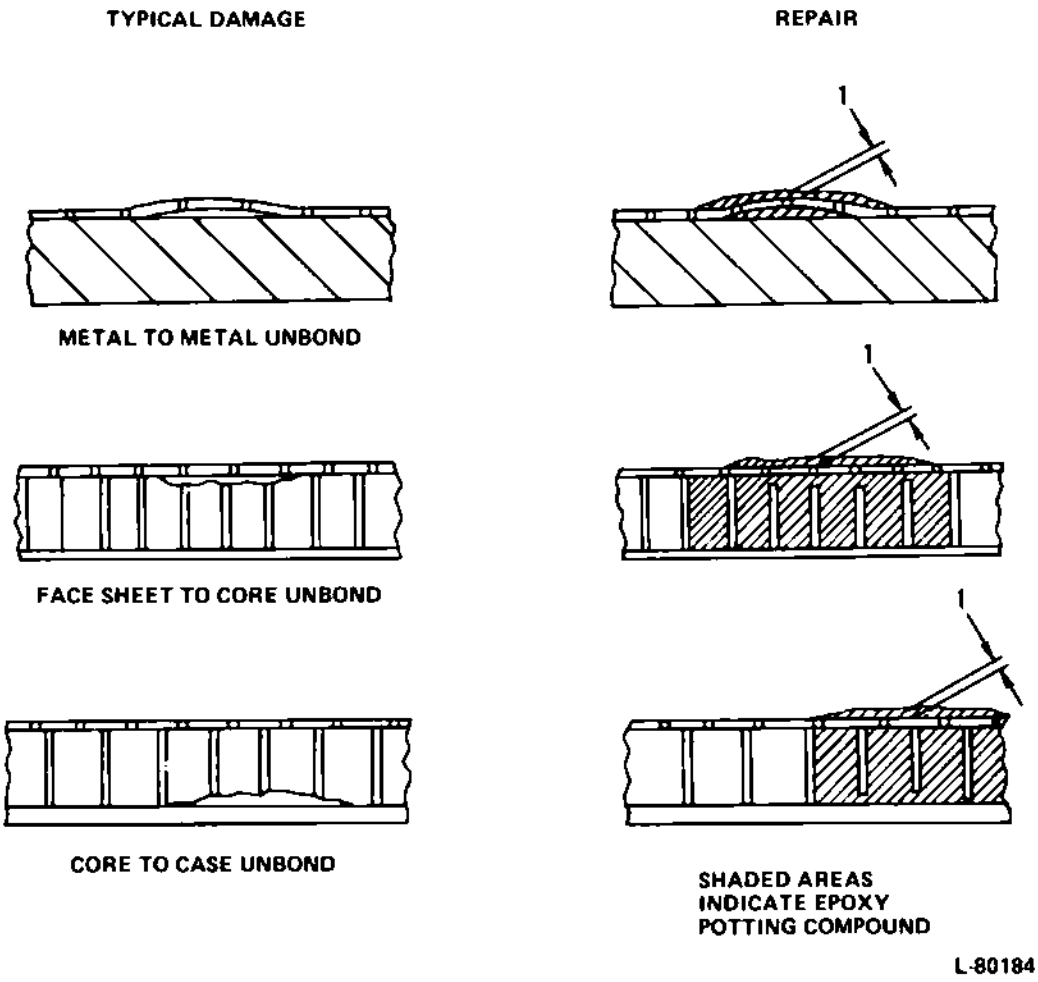


1. 40.138 - 40.148 Inch Diameter
2. 0.254 Inch Minimum Wall Thickness For PN 808009 (0.005 Inch Below Minimum As-Manufactured Wall Thickness - See Text)
3. 0.868 Inch (Gage Point)

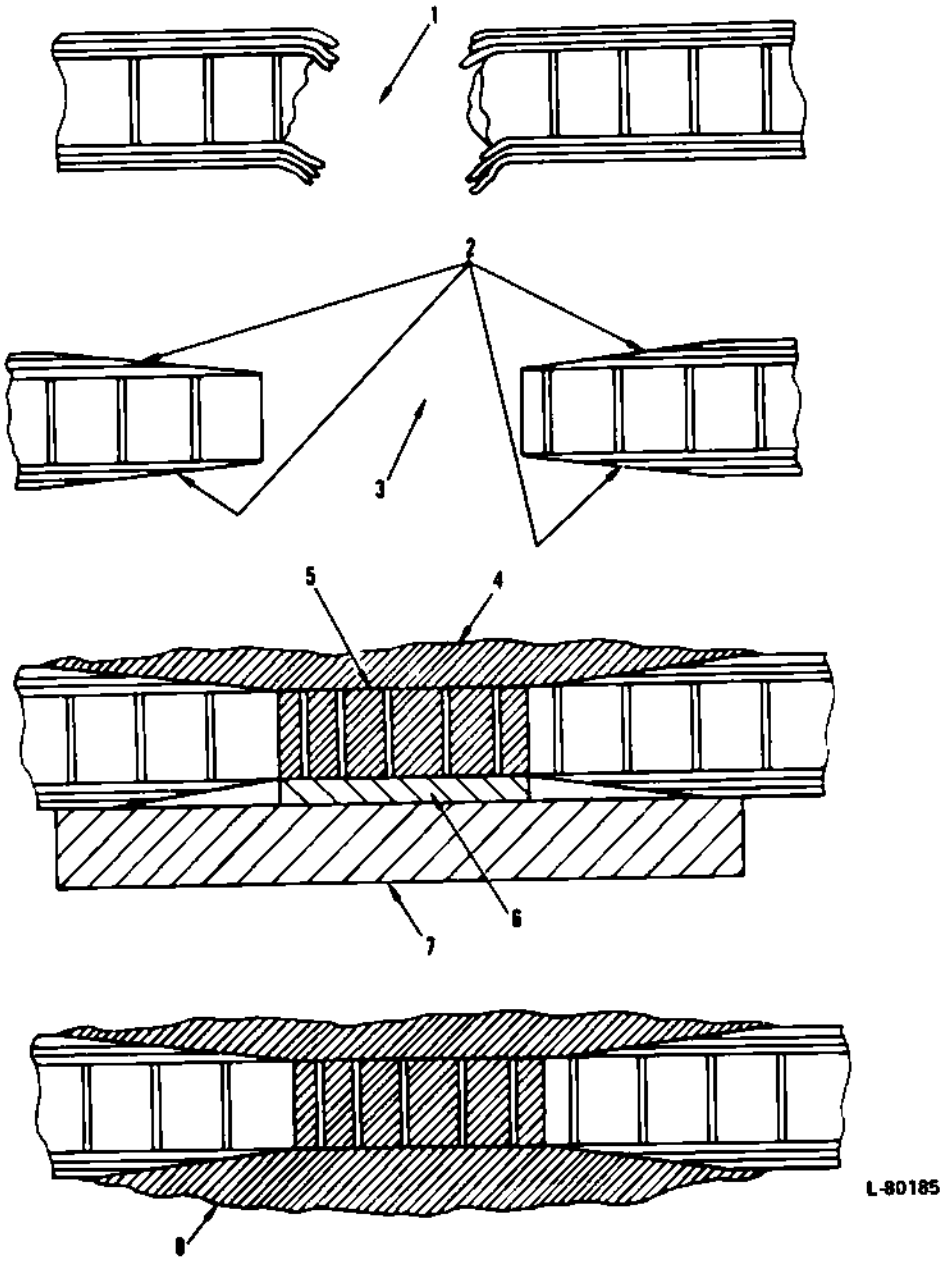
Front Fan Case (JT8D-9,-9A,-11, -15,-15A,-17,-17A Post SB 5948, 5949, 5950)
Figure 202 (Sheet 5)
(Task 72-33-65-220-003)



Fan Case And Liner Terminology
Figure 203
(Task 72-33-65-220-003)



0.020 - 0.030 Inch Sound
Absorbing Liner Epoxy Repair
Figure 204
(Task 72-33-65-220-003)



Liner Honeycomb Repair
Figure 205
(Task 72-33-65-220-003)

1. Damaged Honeycomb
2. Both Surfaces Beveled
3. Hole Trimmed
4. Epoxy Compound On First Side
5. Replacement Core
6. Temporary Shim
7. Temporary Block Or Mold
8. Epoxy Compound On Second Side

Key to Figure 205

COMPRESSOR INTERMEDIATE CASE ASSEMBLY - DESCRIPTION-00

Task 72-34-00-990-001:

1. Compressor Intermediate Section Description

   A. Compressor (Intermediate) Case Assembly
      See Figure 1.

      (1) At the rear of the front compressor rotor is the welded steel compressor intermediate case. This case forms the outer wall of the basic inner engine from the fan discharge vanes to the diffuser case front flange.

      (2) The sixth stage steel vanes and the No. 3 bearing housing are welded inside the case. The No. 2 bearing housing is bolted to the front face of the case. A steel support and a support bushing below it are positioned at the bottom center of the case to accommodate the main accessory drive gearshaft bearing housing. Positioned inside the bearing housing is the main accessory drive bevel gearshaft, in a roller bearing at the top and a ball bearing at the bottom.

   B. Fan Discharge Rear Compressor Section Inner Duct

      (1) Riveted to the rear of the compressor intermediate case is the fan discharge rear compressor section inner duct. This cylindrical steel duct forms the inner wall of the fan discharge air passage at this location and the flanges are fabricated on the inside surface to accommodate the air flow. The rear flange of this case is equipped with self-locking nuts flared securely in place.

      (2) Two double-hole low pressure air bleed bosses are near the front, each approximately 45 degrees above the horizontal centerline.

      (3) At the rear are two single-hole eighth stage air bleed bosses, each approximately 45 degrees above the horizontal centerline. On engines equipped with an 8th stage bleed system, bosses are provided for 8th stage bleed valves (single boss for early systems, three bosses for current systems).

   C. Compressor Intermediate Fan Case

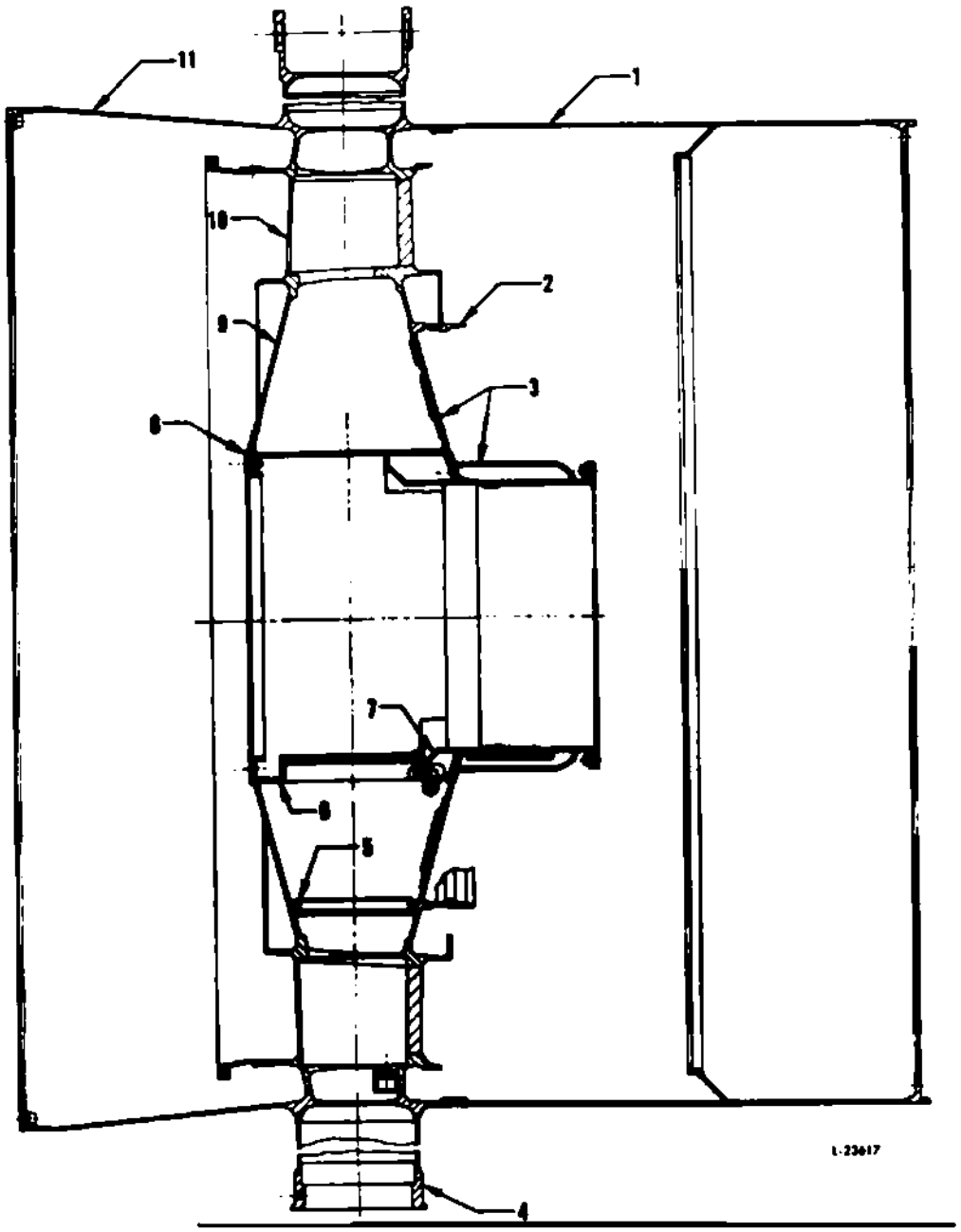
(1) Secured to the rear flange of the front compressor section outer duct, between Flanges F and G is the compressor intermediate fan case. The compressor intermediate fan case is an integral part of the outermost diameter of the compressor (intermediate) case.

(2) The compressor intermediate fan case incorporates streamlined struts between the intermediate case and the outer diameter of the engine. The larger six o'clock strut accommodates the accessory gearbox main drive shaft.

(3) The front mounting points of the engine are on the outer flange of this case and the accessory gearbox is secured to it at the bottom.

D. Main Accessory Drive Bevel Gearshaft and Bearings

(1) The main accessory drive bevel gearshaft is driven by the gearbox drive bevel gear which is inside the No. 3 bearing, splined to the front hub of the rear compressor rotor, and rotates at N2. The main accessory drive bevel gearshaft, in turn, rotates the gearbox drive shaft through the splined drive shaft coupling.



Compressor Intermediate
Case Construction
Figure 1
(Task 72-34-00-990-001)

COMPRESSOR INTERMEDIATE CASE ASSEMBLY - DESCRIPTION-00

1. Fan Discharge Rear Compressor Inner Duct
2. Rear Compressor Rotor Front Airseal Ring
3. No. 3 Bearing Housing Support
4. Compressor Intermediate Case
5. Gearbox Drive Bearing Housing Lower Support
6. Gearbox Drive Bearing Housing Upper Support
7. Seal Bleed Manifold Segment
8. Mounting Flange For No. 2 Bearing Housing
9. No. 2 Bearing Housing Support
10. Sixth Stage Vane
11. Fan Discharge Front Compressor Inner Duct

Key to Figure 1

R FRONT COMPRESSOR OUTER DUCT - REPAIR-00

R Task 72-34-07-300-001:

R 1. Front Compressor Outer Duct Crack And Indentation Repair

R NOTE: Cracks a maximum of 10 inches long in the outer duct can
R get a stop drill repair. Do a periodic inspection of
R the repair, and a crack more than 10 inches in length is
R cause for rejection (or must get the patch repair in this
R section).

R A. Duct Patch Repair For Patches Not In Flange Areas
R See Figure 801.

R NOTE: Patch repair duct walls that show sharp indentations
R which break or crack the duct wall or indentations
R with corners less than 0.062 inch radius or
R indentations more than 0.015 inch deep.

R NOTE: Before a patch is installed, make sure that the patch
R will not cause a blockage of engine or aircraft
R external hardware.

R (1) Cut out the damaged area in the duct with a circle
R two (2) inches diameter maximum. The circle must
R remove all of the crack or indentation. Adjust rivet
R quantities where necessary, but do not install rivets
R more than one and one-half inches apart.

R (2) Make a patch from 6061 T6 aluminum alloy 0.062 inch
R thick, and cut the patch to the dimensions in the
R figure.

R (3) Bend the patch to get as good a mating fit as possible
R with the duct contour. Attach the patch tightly into
R position on the duct.

R (a) Transfer drill rivet holes for PN 626736 rivets
R (Cherry rivet No. CR-2249-4-3). Remove the patch
R and remove burrs from the holes.

R NOTE: PN 626736 rivets are available from Pratt &
R Whitney Customer Parts Support.

R (4) Clean the bond surfaces by SPOP 208, local wipe method.
R See Standard Practices, Task 70-00-00-100-004, Section
R 70-00-00, (Cleaning-04).

(5) Apply PWA 36003-2 sealant to the inner surface of the patch as shown approximately 0.015 - 0.040 inch thick.

NOTE: If PWA 36003-2 Sealant is not available, GE RTV 90, GE RTV 159, or EA 934 (PWA 457) epoxy resin are permitted. Apply these sealants by the manufacturers' instructions.

(6) Put the patch in position and apply some standard sheet metal fasteners to attach the parts together for initial riveting. Install and compress sufficient rivets to hold the patch in position.

(7) Remove the sheet metal fasteners and install and compress the remaining rivets. Make sure that all rivets are tight.

(8) Record in the engine log that inspection of the patch repair is necessary at the subsequent shop visit to make sure that the rivets are tight and that cracks did not extend.

(9) For PWA 36003-3 Sealant, cure for 24 hours at 77°F (25°C) at 50 percent relative humidity. Apply anodize touch-up (SPOP 42) to all bare surfaces. See Section 70-00-00, Repair-10, Standard Practices.

B. Flange And Duct Crack Patch Repair (Engines Prior To SB 2415)
See Figure 802.

NOTE: For Flange E at the 2 o'clock position where repair could have an effect on air shutoff valve bracket interchangeability and fan duct reidentification data, refer to SB 2728.

(1) Repair axial cracks not more than one and three-quarter inches in length, circumferential body cracks up to eight inches long, and diagonal cracks that do not extend through the flange as follows:

(a) Stop drill cracks with a 0.178 - 0.198 inch diameter hole as shown in the figure.

(b) Make a duct patch from 0.040 inch thick AISI 321/347 stainless steel and bend it to the contours of the duct.

R FRONT COMPRESSOR OUTER DUCT - REPAIR-00

R (c) Fusion (TIG) weld another piece of the same steel
R to the patch at a 90-degree angle to fit against
R the flange with AMS 5680 filler material.

R (d) Cut the welded duct and flange patch to have
R a good fit with the duct. Make marks on the
R flange patch to drill the holes to align with the
R boltholes in the duct flange.

R (e) Remove the bolts and put the patch in position
R against the flange to transfer drill the rivet
R holes.

R (f) Attach the patch to the duct and transfer drill
R the rivet holes and boltholes where necessary.
R Remove the patch and remove burrs from all holes.

R (g) Clean all bond surfaces by SPOP 208. Refer to
R Standard Practices, Task 70-00-00-100-004, Section
R 70-00-00, (Cleaning-04).

R (h) Apply PWA 36003-2 adhesive sealant to the inner
R surfaces of the patch approximately 0.015 - 0.040
R inch thick.

R NOTE: If PWA 36003-2 adhesive is not available,
R alternate sealants specified in Paragraph
R A. are permitted.

R (i) Attach the patch in position with some standard
R sheet metal fasteners and install and compress
R some PN 626736 rivets (Cherry Rivet No.
R CR-2249-4-3).

R (j) Remove the sheet metal fasteners and install and
R compress the remaining rivets.

R (k) If PWA 36003-2 adhesive is used, cure after
R riveting for 24 hours at 77°F (25°C) at 50 percent
R humidity. Use manufacturers' instructions for
R alternate sealants.

R FRONT COMPRESSOR OUTER DUCT - REPAIR-00

R (1) Install bolts, washers, spacers and brackets where
R necessary. Torque the bolts.

R NOTE: Record in the engine log that inspection
R of the patch repair is necessary at the
R subsequent shop visit to make sure that the
R rivets are tight and that cracks did not
R extend.

R (2) For cracks which are only in the flange, make a
R reinforcing plate from AISI 321/327 stainless steel to
R have a good fit with the flange contour.

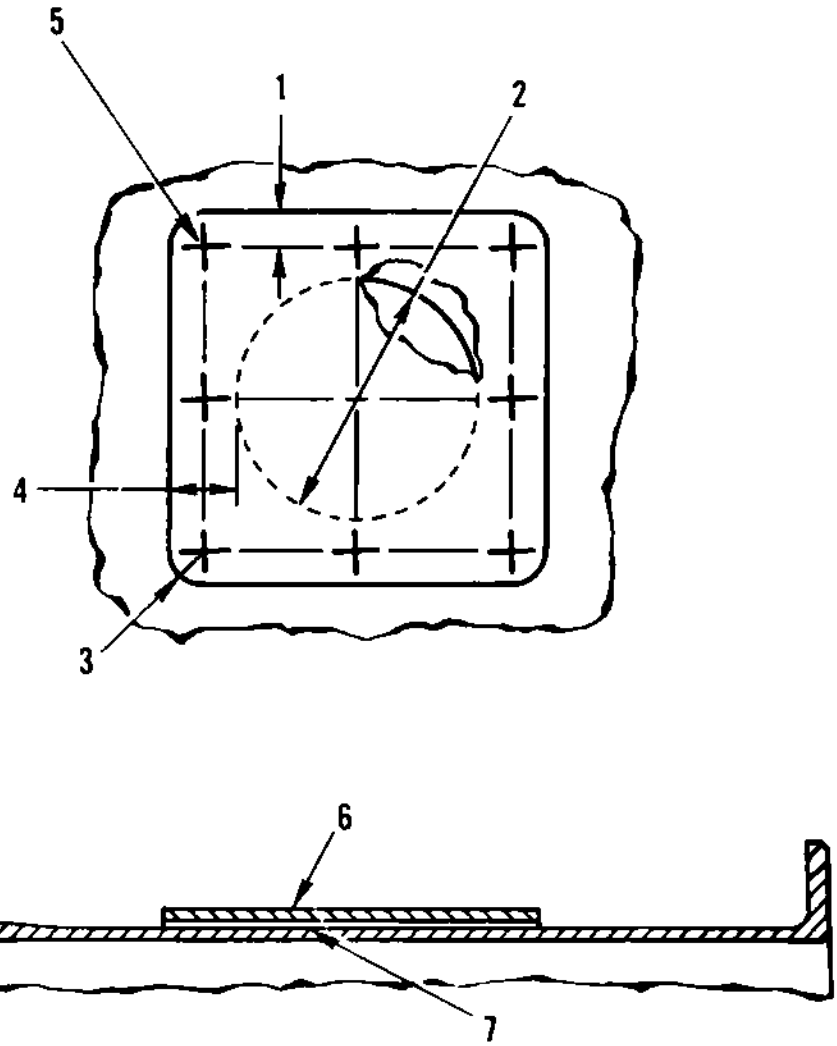
R (a) Remove the flange bolts, attach the plate to the
R flange, and transfer drill the boltholes.

R (b) Do a stop drill repair of cracks (see the
R procedure above).

R (c) Install the plate, bolts, washers, spacers and
R brackets where necessary. Attach the plate with
R the flange bolts. Torque the bolts.

R NOTE: Rivet the reinforcing plate permanently to
R the flange at the subsequent shop visit.

R FRONT COMPRESSOR OUTER DUCT - REPAIR-00



L-73556

R 1. 0.280 Inch. Four Places
R 2. 2.000 Inch Diameter Maximum Hole To Repair Cracks Or
R Indentations.
R 3. 0.250 - 0.281 Inch Radius. Chamfer 0.100 - 0.120 Inch X 45°
R Four Places
R 4. 0.560 Inch Minimum. Machine Index 6 Patch To This Dimension
R To Get The Smallest Possible Patch.
R 5. Rivet, Eight Per Patch Maximum; Four Per Patch Minimum.
R Maximum Of 40 Locations Where Necessary.
R 6. Reference Patch
R 7. Apply Adhesive Up To Five (5) Places Where Necessary

R Duct Patch Repair
R Figure 801 #72-34-07
R (Task 72-34-07-300-001) REPAIR-00

R FRONT COMPRESSOR OUTER DUCT - REPAIR-00

R
R
R

R FRONT COMPRESSOR OUTER DUCT - REPAIR-00

R 1. Rivet In Pattern Shown
R 2. 1.500 Inch Minimum
R 3. 0.969 - 1.031 Inch Radius Both Ends. Machine These Radii When Patch Length Is Shorter.
R 4. 1.500 Inch Minimum Both Ends
R 5. Axial Crack. Stop Drill With 0.178 - 0.198 Inch Diameter Hole
R 6. Circumferential Body Crack 8 Inches Long Maximum. Stop Drill With 0.178 - 0.198 Inch Diameter Hole
R 7. 0.450 Inch
R 8. 0.625 Inch (Typical)
R 9. 3.200 Inch Minimum
R 10. 1.500 Inch Minimum
R 11. 0.400 Inch Minimum
R 12. 0.500 Inch
R 13. Diagonal Crack. Stop Drill With 0.178 - 0.198 Inch Diameter Hole.

R Key to Figure 802

REAR COMPRESSOR OUTER DUCT - REPAIR-00

Task 72-34-08-300-001:

1. Rear Compressor Outer Duct Crack And Indentation Repair

A. Blend Repair

NOTE: This repair is for dents 0.015 inch deep maximum.

(1) Do a blend repair of the damaged area by SPOP 533. Refer to Task 70-00-00-380-002, Section 70-00-00 (Repair-02), Standard Practices.

(2) Do a fluorescent penetrant inspection of the blended area by SPOP 70, normal sensitivity. Refer to Task 70-00-00-230-001, Section 70-00-00, (Inspection/Check-01), Standard Practices.

(3) Do an anodize touch-up of bare surfaces by SPOP 42. Refer to Task 70-00-00-380-010, Section 70-00-00, (Repair-10).

NOTE: Do a patch repair on duct walls that show sharp dents which break or crack the duct wall or have an indentation with corners less than 0.062 inch radius or indentations that are more than 0.015 inch deep.

B. Crack Repair (Cracks 5 Inches Long Maximum)
See Figure 801.

(1) Repair cracks five inches long maximum by one of the methods shown:

(a) Stop Drill Procedure

1 Stop drill cracks five inches long maximum in the outer duct with a 0.1875 inch diameter drill. Drill a hole at each end of the crack.

2 Do a periodic inspection of the duct repair at 100 cycle intervals.

(b) Patch Repair

NOTE: Before a patch is installed, make sure the patch will not cause a blockage of engine or aircraft external hardware.

REAR COMPRESSOR OUTER DUCT - REPAIR-00

1 Cut out the damaged area in the duct with a circle five inch diameter maximum. The circle must remove all of the crack or indentation.

2 Make patches of 6061 T6 aluminum alloy 0.062 inch thick, and cut the patch to shape as shown in the figure.

3 Bend the patch to have as good a fit as possible with the contour of the duct. Attach the patch tightly in position on the duct.

R 4 Transfer drill rivet holes for rivets, reference Cherry rivet No. CR3223-6-3 or equivalent.

NOTE: Rivet length and quantities will be different at each patch location, but rivets must not be more than one and one-half inches apart.

5 Remove the patch and remove burrs from the holes.

6 Clean the bond surfaces by SPOP 208, local wipe method. Refer to Task 70-00-00-100-004, Section 70-00-00 (Cleaning-04), Standard Practices.

7 Apply PWA 36003-2 sealant or PWA 457 epoxy resin to the inner surface of the patch as shown approximately 0.015 - 0.040 inch thick. Refer to Standard Practices, Task 70-00-00-400-003, Section 70-00-00, (Removal/Installation-03).

8 Put the patch in position on the duct and apply some standard sheet metal fasteners to attach the parts together for initial riveting. Install and compress sufficient rivets to hold the patch in position.

9 Remove the sheet metal fasteners. Install and compress the remaining rivets. Examine the rivets to make sure that they are tight.

10 Cure the PWA 36003-2 or PWA 457 epoxy resin.

11 Do an anodize touch-up of bare surfaces by SPOP 42. Refer to Standard Practices, Task 70-00-00-380-010, Section 70-00-00. (Repair-10).

12 Record in the engine log that inspection of the patch repair is necessary at the subsequent shop visit to make sure that the rivets are tight and that cracks did not extend.

C. Aluminum Duct Crack Patch Repair (Cracks 10 Inches Long Maximum)
See Figure 802.

NOTE: Use a patch repair on a duct that shows sharp dents which break or crack the duct wall or have an indentation with corners less than 0.062 inch radius or indentations that are deeper than 0.015 inch. There is no limit to the number of large patches or small plates used, but the total number of patches must not be more than ten for each duct.

NOTE: This is applicable to circumferential cracks ten inches long maximum and to all axial cracks (no length limit), except those that end five inches or less from the case flange.

NOTE: Before a patch is installed, make sure that the patch will not cause a blockage of engine or aircraft external hardware.

(1) Stop drill the crack ends with a 0.1875 inch diameter drill.

(2) Use an AMS 4037 patch that is 0.059 - 0.065 inch thick. Cut the patch to shape as shown. See Figure 802.

R (3) Drill rivet holes in the patch for the rivets, reference Cherry rivet No. CR3223-6-3 or equivalent. Remove all burrs from the holes.

(4) Bend the patch to have as good a fit as possible with the contour of the duct. Attach the patch tightly in position on the duct.

(5) Transfer drill the rivet holes to the duct. Remove the patch and remove burrs from the holes.

NOTE: The number of rivets necessary and the size of the patches will increase or decrease with the length of the crack. See Figure 802 for the rivet pattern requirements.

(6) Clean the bond surfaces by SPOP 208, local wipe method. Refer to Standard Practices, Task 70-00-00-100-004, Section 70-00-00, (Cleaning-04).

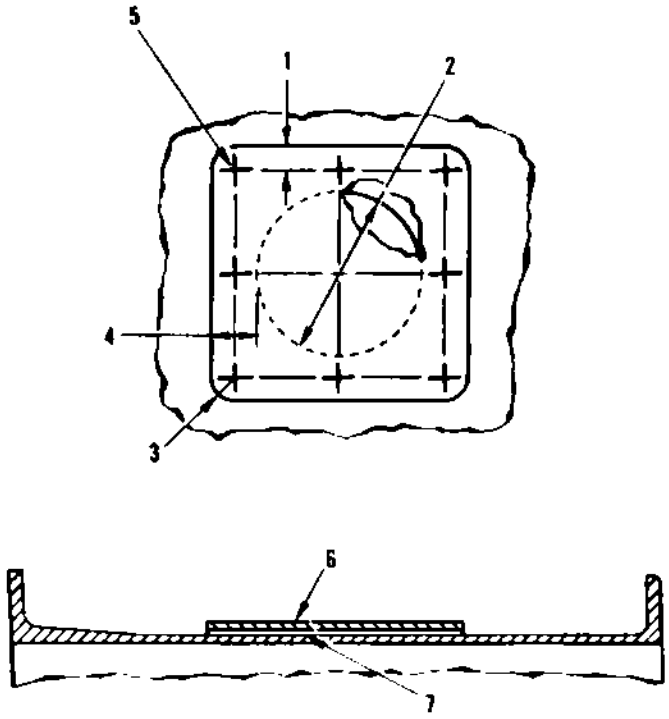
(7) Apply PWA 36003-2 sealant or PWA 457 epoxy resin to the inner surface of the patch as shown approximately 0.015 - 0.040 inch thick. Refer to Standard Practices, Task 70-00-00-400-003, Section 70-00-00, (Removal/Installation-03).

(8) Put the patch in position on the duct and apply some standard sheet metal fasteners to attach the parts together for initial riveting. Install and compress sufficient rivets to hold the patch in position.

(9) Remove the sheet metal fasteners. Install and compress the remaining rivets. Examine the rivets to make sure that they are tight.

(10) Cure the PWA 36003-2 sealant.

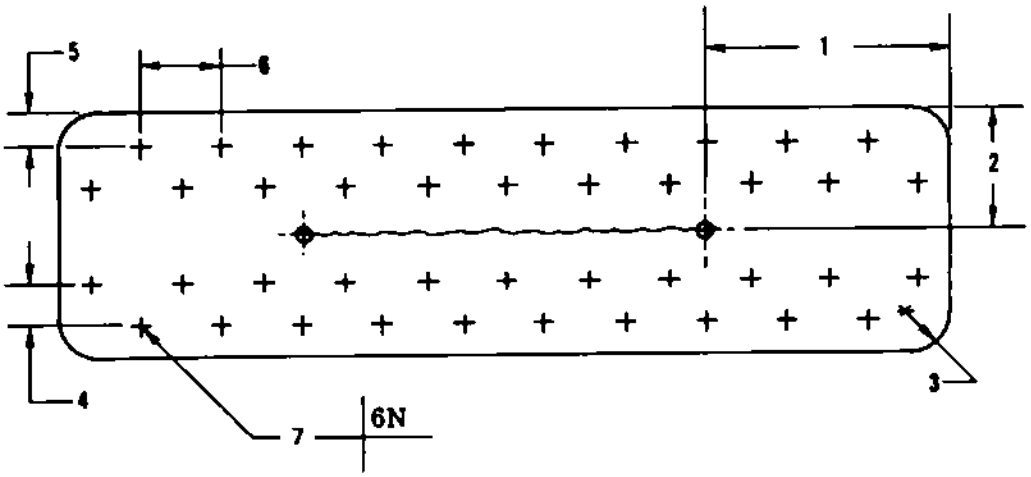
(11) Do an anodize touch-up of bare surfaces by SPOP 42. Refer to Standard Practices, Task 70-00-00-380-010, Section 70-00-00, (Repair-10).



L-H6744 (0204)

1. 0.280 Inch. Four Places
2. 5.000 Inch Diameter Maximum Hole To Repair Cracks Or Indentations.
3. 0.250 - 0.281 Inch Radius. Chamfer 0.100 - 0.120 Inch X 45° Four Places
4. 0.560 Inch Minimum. Machine Index 6 Patch To This Dimension To Get The Smallest Possible Patch.
5. Rivet Eight Places For Each Patch Maximum; Four Places For Each Patch Minimum. 40 Places Maximum Wher Necessary.
6. Reference Patch
7. Apply Adhesive Five Places Maximum Where Necessary.

Duct Patch Repair (Cracks 5 Inches Maximum)
Figure 801
(Task 72-34-08-300-001)



L-H6745 (0204)

1. 3.000 Inches ± 0.062, Two Sides
2. 1.500 Inches ± 0.062, Two Sides
3. 1.000 Inch Radius ± 0.062, Four Places
4. 0.500 Inch Maximum
5. 0.400 Inch Minimum
6. 0.560 Inch Minimum; 1.100 Inch Maximum
7. Cherry Rivet PN CR3223-6-3 Or Equivalent

Aluminum Fan Duct Patch Repair
(Cracks 10 Inches Maximum)
Figure 802
(Task 72-34-08-300-001)

REAR COMPRESSOR ROTOR AND STATOR ASSEMBLY - DESCRIPTION-00

Task 72-36-00-990-001:

1. Rear Compressor Section

A. The rear compressor rotor is driven by the first stage of the turbine through the rear compressor drive turbine (short) shaft. The turbine shaft splines onto the rear compressor rear hub and is retained by the turbine shaft coupling.

B. The purpose of the rear compressor is to further compress the air delivered by the front compressor and to then feed this air into the diffuser case and combustion section.

C. Rear Compressor Stators

(1) The seventh through twelfth stage stator assemblies are each single piece continuous ring construction incorporating box outer shrouds and stainless steel vanes. The outer shroud of each stage extends forward around the blades. The inner shroud has an airseal ring which provides a mating surface for the knife-edge airseals of the rotor.

(2) Three locking straps retain the 10th, 11th, 12th stage vane shrouds at their OD. The seventh, eighth, and ninth stages are retained securely in position by lockwired stator locks on the shroud lugs (or lockwired lugs) and an extended rear flange on the ninth stage outer shroud. A tube and baffle on the ninth stage stator directs eighth stage air into the No. 4 bearing seal air system.

(3) At the 13th stage compressor exit, vanes are secured in the exit stator assembly mounted in the forward end of the diffuser case. These vanes are aerodynamically part of the rear compressor but because of their location are described with the diffuser case.

D. Rear Compressor Rotor

(1) The rear compressor utilizes a rotor having seven stages of disks and blades, separated by disk spacers, and six stator vane stages.

(2) The blade stages are numbered seven through thirteen from front to rear. The vane stages, behind their blade stages are numbered correspondingly, seven through twelve in the rotor and stator assembly and the 13th stage and compressor exit vanes in the front end of the diffuser case.

(3) Twelve tierods fasten the disks, spacers, and front and rear hubs together axially. For engines not incorporating the integral 8th stage disk/rear compressor front hub configuration, the front hub is positioned at the 9th stage disk so that the 7th and 8th stage disks are cantilevered forward. For engines incorporating an integral 8th stage disk/rear compressor front hub, the front hub is integral with the 8th stage disk so that the 7th stage disk is cantilevered forward. Knife-edge airseals on the disk spacers are positioned just inside an airseal ring on the inner shroud of each corresponding vane stage. A triple knife-edge airseal (JT8D-1,-1A,-7,-7A,-7B,-9,-9A, -11,-15,-17 and -17R only) is secured to the front of the 7th stage disk and a four edge airseal is integral with the rear of the 13th stage disk.

(4) Blade attachment to the disks is accomplished by a dovetailed lock at the blade root, with the exception of the 7th stage which uses a pin-joint attachment.

(5) The 7th, 8th, and 9th stage blades of the rear compressor rotor are titanium. The 10th through 13th stage blades are steel. The rear compressor rotor disks are steel except for the 13th stage disk, which is made of nickel alloy. The 13th stage disk incorporates an airsealing configuration on the rear having four knife-edges. The knife-edges match the steel 13th stage airsealing ring positioned inside the diffuser case.

(6) An oil sealing sleeve extends from the rear of the front hub ID to a steel bushing in the bore of the rear hub. Metal seal rings are positioned in two grooves in the rear end of the sleeve inside the bushing.

(7) The rear compressor is balanced dynamically as a unit. Counter weights may be riveted to the front of the seventh stage disk, the front hub, and to the OD of the rear hub adjacent to the point of attachment.

(8) The No. 4 bearing inner races and oil baffle are secured on the OD of the rear hub by an inner race retaining nut locked in place with a keywasher. The No. 4 and 5 bearing oil suction pump drive gear is held on the rear of the hub by two lockrings.

(9) The rear compressor rotor is driven by the first stage of the turbine through the rear compressor drive turbine (short) shaft. The turbine shaft splines onto the rear compressor rear hub, and is retained by the turbine shaft coupling.

REAR COMPRESSOR ROTOR AND STATOR ASSEMBLY - INSPECTION/CHECK-00

Task 72-36-00-220-001:

1. Rear Compressor Inspection

   A. Twelfth And Thirteenth Stage Compressor Blade Inspection

      NOTE: Perform this inspection procedure during hot section inspection. See Section 72-40, Inspection/Check.

      (1) Looking forward through diffuser case, visually inspect 12th and 13th stage compressor blades and exit stator vanes for evidence of nicks, dents and cracks.

         (a) Twelfth And Thirteenth stage blade leading and trailing edge damage must not exceed limits in Figure 601.

         (b) If blade damage exceeds limits given, engine must be removed and disassembled for repair.

   B. Twelfth And Thirteenth Stage Blade Tip Fracture Limits See Figure 602.

      (1) Inspect all 13th stage and as much as possible of the 12th stage compressor blades for airfoil tip fractures. For this inspection an airfoil tip fracture is defined as a fracture originating at blade airfoil tip and extending to blade trailing edge. See Figure 602.

         (a) Engines may continue in service provided only one compressor blade is fractured, as described above, in either 12th or 13th stage. These engines must be borescope inspected again at intervals not to exceed 450 hours.

         (b) Engines with more than one blade tip fracture, as described above, for 12th or 13th stage compressor blades must be removed from service within 100 hours and disassembled for compressor repair.

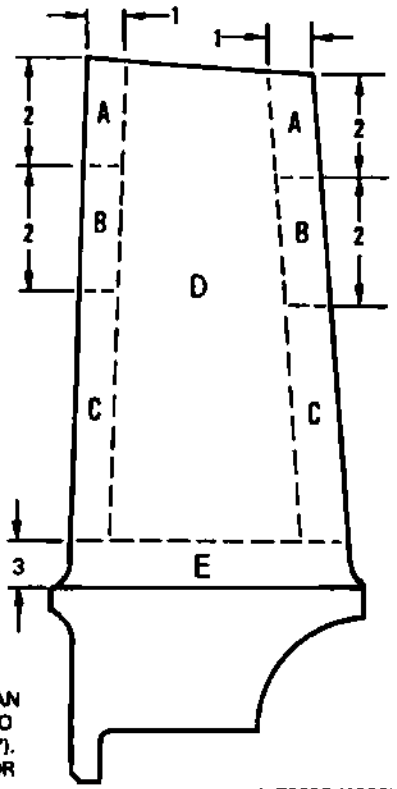
         (c) Engines with a single 12th or 13th stage blade with multiple fractures must be removed from service within 100 hours and disassembled for compressor repair. Typical multiple fractures are shown in Figure 602.

         (d) Damage limits must be maintained for 13th stage compressor blade leading and trailing edges as described in step (1).

(e) All other required operational parameters and limits must be maintained.

AREA	ACCEPTABLE DAMAGE LIMITS
A	ANY DAMAGE UP TO 1/16 INCH (1.588mm) ANY ROUND BOTTOMED DAMAGE UP TO .135 INCH (3.429mm) NO TEARS OR CRACKS ALLOWED BEYOND 1/16 INCH (1.588mm)
B	ANY DAMAGE UP TO 1/16 INCH (1.588mm) ANY ROUND BOTTOMED DAMAGE UP TO .135 INCH (3.429mm) NO TEARS OR CRACKS ALLOWED BEYOND 1/16 INCH (1.588mm)
C	INDENTATIONS UP TO 1/32 INCH (0.793mm) NO TEARS OR CRACKS
D	ANY INDENTATION NO TEARS OR CRACKS
E	INDENTATIONS UP TO 0.010 INCH (0.254mm) NO TEARS OR CRACKS

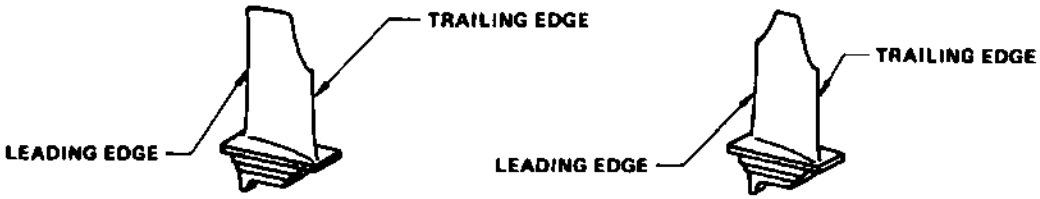
NOTE: DAMAGE THAT TRANSCENDS DEFINED BOUNDARIES CAN BE ADDRESSED BY ALLOWING THE GREATER DAMAGE LIMIT TO PREVAIL (NO TEARS OR CRACKS ALLOWED IN AREAS "C" OR "D"). THIS NOTE DOES NOT APPLY BETWEEN BOUNDARY "C TO "E" OR "D TO "E".

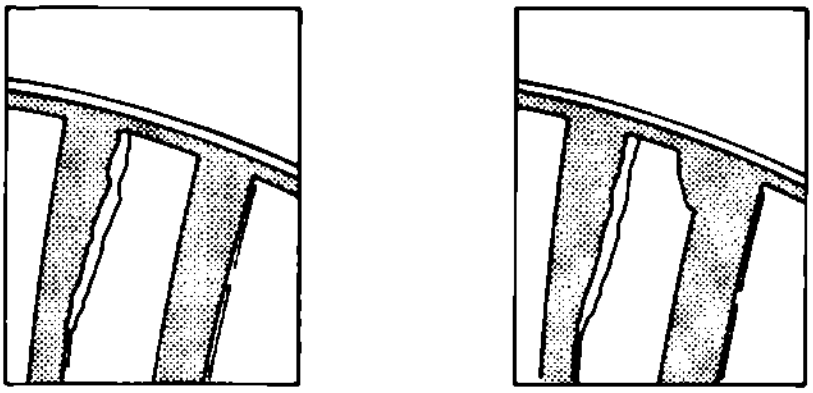


L-79399 (1298)

1. 3/16 Inch
2. 1/4 Inch
3. 1/8 Inch

Twelfth And Thirteenth Stage
Blade Inspection Limits
Figure 601
(Task 72-36-00-220-001)





TYPICAL SINGLE FRACTURE WITH TRAILING EDGE TIP LOSS

TYPICAL MULTIPLE FRACTURE WITH TRAILING EDGE AND LEADING EDGE TIP LOSS

L-87065

Twelve And Thirteenth
Stage Blade Tip Fractures
Figure 602
(Task 72-36-00-220-001)

REAR COMPRESSOR ROTOR AND STATOR ASSEMBLY - REPAIR-00

Task 72-36-00-300-001:

1. Seventh Stage Compressor Blade Airfoil Blend Repair (For An Assembled Engine)

A. Equipment And Materials Required

Special Tools:

PWA 10408	Starter Drive Adapter or Deep Socket
PWA 49117*	Video System Kit, which consists of: 6mm Flexible Borescope (6 feet long) 3mm Flexible Borescope (6 feet long) High Intensity Light Source Video System with Cassette recorder, measuring system, character generator, and remote control

R NOTE: * PWA 49167 Video System is permitted as an
R alternate. Equivalent equipment is also permitted.

R	PWA 101111**	Blending System, which consists of:
	PWA 49091	Controller
	PWA 49092	Foot Pedal
	PWA 49093	Extension Cord
	PWA 101112	Power Handle
	PWA 101113	Blending Tip
	PWA 101114	Polishing Tip
	PWA 101115	Measuring Handle And Detail-1 Tip Adapter
	PWA 101116	Calibration Fixture
	PWA 101117	Installation And Removal Adapter
	UST-3	Storage Case

R NOTE: ** Equivalent equipment is permitted.

Standard Tools:
12-inch .500 inch drive ratchet

B. General

(1) The purpose of this repair is to blend the leading edge of damaged 7th stage compressor blades, found by routine damage inspection, in an assembled engine. Seventh stage blades that are damaged more than the borescope limits can be blend repaired to the limits of this repair.

C. Procedure

(1) Calibrate the measuring system as follows:

(a) Assemble the PWA 101115 Measuring Handle and Detail-1 Tip Adapter.

(b) Insert the 3mm scope into the guide tube of the measuring handle until the scope tip touches the stop. This will set the scope to target distance.

(c) Lock the scope in place by tightening the thumbscrew. The measuring tool hook must be resting against the concave side of the leading edge of the blade; this is the position the hook must be in during measurement of damaged blades inside of the engine.

(d) Attach the camera to the scope and attach the camera cable to the monitor. Then connect the micrometer cable to the monitor.

(e) Turn all video switches on.

(f) Connect the light guide cable to the light source and turn it on.

(g) Pick a square from the grid near the hook that touches the blade leading edge. While viewing the monitor, select span and then datum with the micrometer control box to move the horizontal and vertical lines so they overlay the lines of the selected square.

(h) Go to the menu and select calibrate. Program .100 for both the X and Y coordinates. Select menu, then move the cursor to "blank" to clear the screen. The system is now calibrated and you are ready to measure damage inside the engine.

(2) Measure the damage as follows:

(a) Attach the PWA 10117 Installation and Removal tool to the detail-1 tip adapter.

(b) Insert the tip adapter into the 6th stage bleed port, then into the access hole in the 8th stage HPC stator outer shroud. Face the tip forward.

(c) While holding the installation and removal adapter, attach the PWA 101115 Measuring Handle to the tip. Remove the installation and removal adapter.

R
R

(d) Insert the 3mm scope through the measuring handle and into the tip adapter until it hits the stop. Lock the scope in place.

(e) Attach the camera to the borescope. Attach the light guide to the light source and turn it on.

(f) While viewing the monitor, move the tip so that the hook is resting against the concave side of the leading edge next to the damage. Measure the damage as previously outlined in step C.(1). See Figure 801 for damage limits that can be repaired by this repair.

NOTE: It may be necessary to rotate the compressor slightly to optimize the view.

(g) After the damage is measured, remove the camera and borescope. While holding the removal and installation tool, remove the tip adapter extension. Next, remove the installation and removal tool and tip.

(3) Blend the repairable damage as follows:

(a) Connect the PWA 101117 Installation and Removal Adapter to the PWA 101113 Blending Tip and insert the tip into the access hole.

(b) While holding the insertion tool, install the PWA 101112 Power Handle.

(c) Insert the 6mm scope into the front of the high compressor in line with the position of the damaged blade. Work the scope rearward toward the damaged blade until it is in view.

NOTE: Very slight rotation of the compressor may be required in order to get the scope in position to view blending of the damage.

(d) When the damage is in views, connect the camera to the scope.

(e) While watching the monitor, blend the damage as follows:

1 Start the rotation of the diamond ball by depressing the PWA 49092 Foot Pedal.

R
R

2 With a slight downward pressure and a back-and-forth motion, blend out the damage. The length of the blend must be a minimum of four times the depth. Remove an additional 0.010 inch of material beyond the measured damage to endure that all the damage has been removed.

(f) When all the damages has been blended out, disconnect the power handle and remove the blending tip. Install the PWA 101114 Polishing Tip by the same procedure used to install the blending tip in step C.(3)(a).

Task 72-36-00-300-002:

2. Eighth Stage Compressor Blade Airfoil Blend Repair (For An Assembled Engine)

A. Equipment And Materials Required

Special Tools:

PWA 10408	Starter Drive Adapter or Deep Socket
PWA 49117*	Video System Kit, which consists of: 6mm Flexible Borescope (6 feet long) 3mm Flexible Borescope (6 feet long) High Intensity Light Source Video System with Cassette recorder, measuring system, character generator, and remote control

NOTE: * PWA 49167 Video System is permitted as an alternate. Equivalent equipment is also permitted.

R

PWA 101111**	Blending System, which consists of:
PWA 49091	Controller
PWA 49092	Foot Pedal
PWA 49093	Extension Cord
PWA 101112	Power Handle
PWA 101113	Blending Tip
PWA 101114	Polishing Tip
PWA 101115	Measuring Handle And Detail-1 Tip Adapter
PWA 101116	Calibration Fixture
PWA 101117	Installation And Removal Adapter
UST-3	Storage Case

R NOTE: ** Equivalent equipment is permitted.

Standard Tools:
12-inch .500 inch drive ratchet

B. General

(1) The purpose of this repair is to blend the leading edge of damaged 8th stage compressor blades, found by routine damage inspection, in an assembled engine. Eighth stage blades that are damaged more than the borescope limits can be blend repaired to the limits of this repair.

C. Procedure

(1) Calibrate the measuring system as follows:

(a) Assemble the PWA 101115 Measuring Handle and Detail-1 Tip Adapter.

(b) Insert the 3mm scope into the guide tube of the measuring handle until the scope tip touches the stop. This will set the scope to target distance.

(c) Lock the scope in place by tightening the thumbscrew. The measuring tool hook must be resting against the concave side of the leading edge of the blade; this is the position the hook must be in during measurement of damaged blades inside of the engine.

(d) Attach the camera to the scope and attach the camera cable to the monitor. Then connect the micrometer cable to the monitor.

(e) Turn all video switches on.

(f) Connect the light guide cable to the light source and turn it on.

(g) Pick a square from the grid near the hook that touches the blade leading edge. While viewing the monitor, select span and then datum with the micrometer control box to move the horizontal and vertical lines so they overlay the lines of the selected square.

(h) Go to the menu and select calibrate. Program .100 for both the X and Y coordinates. Select menu, then move the cursor to "blank" to clear the screen. The system is now calibrated and you are ready to measure damage inside the engine.

(2) Measure the damage as follows:

(a) Attach the PWA 10117 Installation and Removal tool to the detail-1 tip adapter.

(b) Insert the tip adapter into the 6th stage bleed port, then into the access hole in the 8th stage HPC stator outer shroud. Face the tip rearward.

(c) While holding the installation and removal adapter, attach the PWA 101115 Measuring Handle to the tip. Remove the installation and removal adapter.

(d) Insert the 3mm scope through the measuring handle and into the tip adapter until it hits the stop. Lock the scope in place.

(e) Attach the camera to the borescope. Attach the light guide to the light source and turn it on.

(f) While viewing the monitor, move the tip so that the hook is resting against the concave side of the leading edge next to the damage. Measure the damage as previously outlined in step C.(1). See Figure 802 for damage limits that can be repaired by this repair.

NOTE: It may be necessary to rotate the compressor slightly to optimize the view.

(g) After the damage is measured, remove the camera and borescope. While holding the removal and installation tool, remove the tip adapter extension. Next, remove the installation and removal tool and tip.

(3) Blend the repairable damage as follows:

(a) Connect the PWA 101117 Installation and Removal Adapter to the PWA 101113 Blending Tip and insert the tip into the access hole.

(b) While holding the insertion tool, install the PWA 101112 Power Handle.

(c) Insert the 6mm scope into the front of the high compressor in line with the position of the damaged blade. Work the scope rearward toward the damaged blade until it is in view.

NOTE: Very slight rotation of the compressor may be required in order to get the scope in position to view blending of the damage.

(d) When the damage is in views, connect the camera to the scope.

(e) While watching the monitor, blend the damage as follows:

1 Start the rotation of the diamond ball by depressing the PWA 49092 Foot Pedal.

2 With a slight downward pressure and a back-and-forth motion, blend out the damage. The length of the blend must be a minimum of four times the depth. Remove an additional 0.010 inch of material beyond the measured damage to endure that all the damage has been removed.

(f) When all the damages has been blended out, disconnect the power handle and remove the blending tip. Install the PWA 101114 Polishing Tip by the same procedure used to install the blending tip in step C.(3)(a).

Task 72-36-00-300-003:

3. Ninth Stage Compressor Blade Airfoil Blend Repair (For An Assembled Engine)

A. Equipment And Materials Required

Special Tools:

PWA 10408	Starter Drive Adapter or Deep Socket
PWA 49117*	Video System Kit, which consists of:
	6mm Flexible Borescope (6 feet long)
	3mm Flexible Borescope (6 feet long)
	High Intensity Light Source
	Video System with Cassette recorder,

R
R

REAR COMPRESSOR ROTOR AND STATOR ASSEMBLY - REPAIR-00

Special Tools:

(CONTINUED)

		measuring system, character generator, and remote control

NOTE: * PWA 49167 Video System is permitted as an alternate. Equivalent equipment is also permitted.

R	PWA 101111**	Blending System, which consists of:
	PWA 49091	Controller
	PWA 49092	Foot Pedal
	PWA 49093	Extension Cord
	PWA 101112	Power Handle
	PWA 101113	Blending Tip
	PWA 101114	Polishing Tip
	PWA 101115	Measuring Handle And Detail-1 Tip Adapter
	PWA 101116	Calibration Fixture
	PWA 101117	Installation And Removal Adapter
	UST-3	Storage Case

R NOTE: ** Equivalent equipment is permitted.

Standard Tools:
12-inch .500 inch drive ratchet

B. General

(1) The purpose of this repair is to blend the leading edge of damaged 9th stage compressor blades, found by routine damage inspection, in an assembled engine. Ninth stage blades that are damaged more than the borescope limits can be blend repaired to the limits of this repair.

C. Procedure

(1) Calibrate the measuring system as follows:

(a) Assemble the PWA 101115 Measuring Handle and Detail-1 Tip Adapter.

(b) Insert the 3mm scope into the guide tube of the measuring handle until the scope tip touches the stop. This will set the scope to target distance.

(c) Lock the scope in place by tightening the thumbscrew. The measuring tool hook must be resting against the concave side of the leading edge of the blade; this is the position the hook must be in during measurement of damaged blades inside of the engine.

(d) Attach the camera to the scope and attach the camera cable to the monitor. Then connect the micrometer cable to the monitor.

(e) Turn all video switches on.

(f) Connect the light guide cable to the light source and turn it on.

(g) Pick a square from the grid near the hook that touches the blade leading edge. While viewing the monitor, select span and then datum with the micrometer control box to move the horizontal and vertical lines so they overlay the lines of the selected square.

(h) Go to the menu and select calibrate. Program .100 for both the X and Y coordinates. Select menu, then move the cursor to "blank" to clear the screen. The system is now calibrated and you are ready to measure damage inside the engine.

(2) Measure the damage as follows:

(a) Attach the PWA 101117 Installation and Removal tool to the detail-1 tip adapter.

(b) Insert the tip adapter into the 6th stage bleed port, then into the access hole in the 9th stage HPC stator outer shroud. Face the tip forward.

(c) While holding the installation and removal adapter, attach the PWA 101115 Measuring Handle to the tip. Remove the installation and removal adapter.

(d) Insert the 3mm scope through the measuring handle and into the tip adapter until it hits the stop. Lock the scope in place.

(e) Attach the camera to the borescope. Attach the light guide to the light source and turn it on.

R
R

(f) While viewing the monitor, move the tip so that the hook is resting against the concave side of the leading edge next to the damage. Measure the damage as previously outlined in step C.(1). See Figure 803 for damage limits that can be repaired by this repair.

NOTE: It may be necessary to rotate the compressor slightly to optimize the view.

(g) After the damage is measured, remove the camera and borescope. While holding the removal and installation tool, remove the tip adapter extension. Next, remove the installation and removal tool and tip.

(3) Blend the repairable damage as follows:

(a) Connect the PWA 101117 Installation and Removal Adapter to the PWA 101113 Blending Tip and insert the tip into the access hole.

(b) While holding the insertion tool, install the PWA 101112 Power Handle.

(c) Insert the 6mm scope into the front of the high compressor in line with the position of the damaged blade. Work the scope rearward toward the damaged blade until it is in view.

NOTE: Very slight rotation of the compressor may be required in order to get the scope in position to view blending of the damage.

(d) When the damage is in views, connect the camera to the scope.

(e) While watching the monitor, blend the damage as follows:

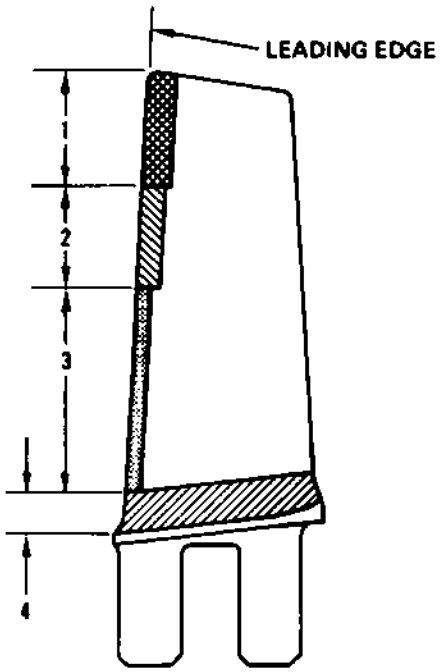
1 Start the rotation of the diamond ball by depressing the PWA 49092 Foot Pedal.

2 With a slight downward pressure and a back-and-forth motion, blend out the damage. The length of the blend must be a minimum of four times the depth. Remove an additional 0.010 inch of material beyond the measured damage to endure that all the damage has been removed.

(f) When all the damages has been blended out, disconnect the power handle and remove the blending tip. Install the PWA 101114 Polishing Tip by the same procedure used to install the blending tip in step C.(3)(a).

BLADE AREA	MAXIMUM BLENDED DEPTH
	0.156 INCH (3.967 MM)
	0.125 INCH (3.175 MM)
	0.062 INCH (1.588 MM)
	NO REPAIR PERMITTED

NOTE: THE ABOVE MAXIMUM BLENDED DEPTH LIMITS ARE AFTER ALL MACHINING. THESE LIMITS INCLUDE THE DAMAGE DEPTH BEFORE REPAIR PLUS AN ADDITION 0.012 INCH (0.305 mm) REMOVAL OF UNDAMAGED MATERIAL BEYOND THE DAMAGE DEPTH.



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1. 0.750 Inch
2. 0.625 Inch
3. Remaining Distance Between Indexes 2 And 4
4. 0.250 Inch

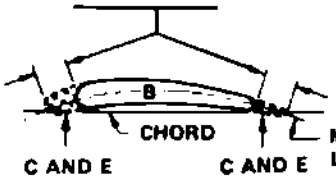
Seventh Stage Blade Blend
Limits For An Assembled Engine
Figure 801
(Task 72-36-00-300-003)

MAXIMUM ALLOWABLE BLENDED NICK LIMITS

BLADE AREA		STAGE 8
	A1	* 3/16"
	A2	* 3/16"
	B	1/32" D
	C	1/8" D
	D	NONE
	E	1/32" D

D = DEPTH

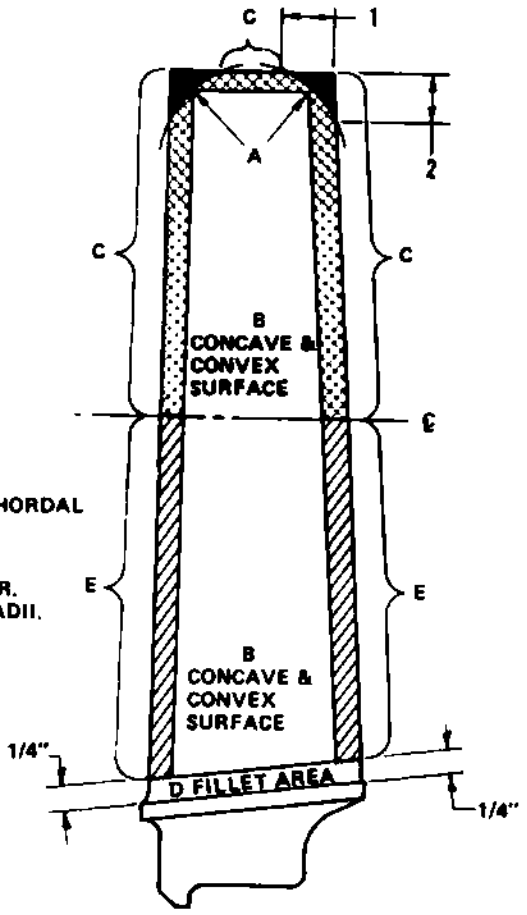
CONTROLLED BY DEPTH LIMIT



BLEND SMOOTHLY WITH EXISTING CONTOUR. RESTORE LEADING AND TRAILING EDGE RADII.

LIMITS IN AREAS "C" AND "E" PERTAIN TO LOCAL, ISOLATED DAMAGE AREAS ONLY AND MUST NOT BE INTERPRETED AS AUTHORITY FOR MATERIAL REMOVAL ACROSS ENTIRE TIP OF LEADING AND TRAILING EDGES, AS MIGHT BE DONE IN SINGLE MACHINING CUT.

* 1/8" X 1/8" MAX. IF BOTH LEADING AND TRAILING EDGE TIP BLENDED



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* BLEND A RADIUS BASED ON ACTUAL DAMAGE AND IF NECESSARY UP TO MAXIMUM LENGTH STIPULATED

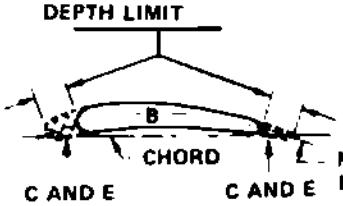
Eighth Stage Blade Blend
Limits For An Assembled Engine
Figure 802
(Task 72-36-00-300-003)

MAXIMUM ALLOWABLE BLENDED NICK LIMITS

BLADE AREA		STAGE 9
	A1	• 3/16"
	A2	• 3/16"
	B	1/32" D
	C	1/8" D
	D	NONE
	E	1/32" D

D = DEPTH

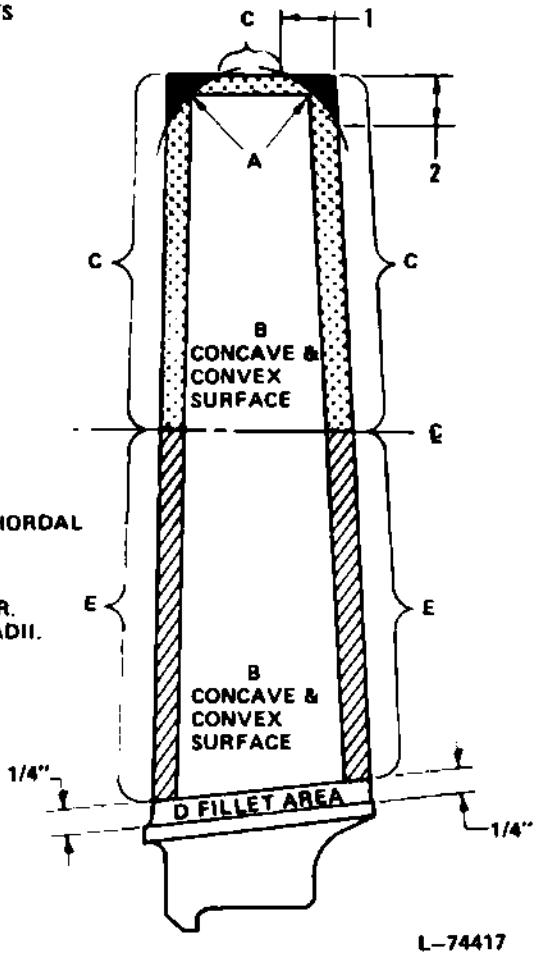
CONTROLLED BY DEPTH LIMIT



BLEND SMOOTHLY WITH EXISTING CONTOUR. RESTORE LEADING AND TRAILING EDGE RADII.

LIMITS IN AREAS "C" AND "E" PERTAIN TO LOCAL, ISOLATED DAMAGE AREAS ONLY AND MUST NOT BE INTERPRETED AS AUTHORITY FOR MATERIAL REMOVAL ACROSS ENTIRE TIP OF LEADING AND TRAILING EDGES, AS MIGHT BE DONE IN SINGLE MACHINING CUT.

• 1/8" X 1/8" MAX. IF BOTH LEADING AND TRAILING EDGE TIP BLENDED



• BLEND A RADIUS BASED ON ACTUAL DAMAGE AND IF NECESSARY UP TO MAXIMUM LENGTH STIPULATED

Ninth Stage Blade Blend Limits
For An Assembled Engine
Figure 803
(Task 72-36-00-300-003)

DIFFUSER SECTION - DESCRIPTION-00

Task 72-37-00-990-001:

1. Diffuser Section

A. General

(1) The function of the diffuser section is to straighten the airflow from the rear compressor and to diffuse the flow to the proper velocity for entry into the combustion chamber. The air passes through the last row of rear compressor blades at a fast rate of speed. This motion is both rearward and circular in pattern around the engine. Two rows of radial straightening exit guide vanes, made of steel and located at the entrance of the diffuser case, slow the circular whirl pattern and convert the whirl velocity energy to pressure energy. After passing through these straightening vanes the air still has a strong rearward velocity. This velocity is so high that it would be nearly impossible to maintain a flame in the air stream. A gradually increasing cross section of the air passage decreases the velocity of the airflow and at the same time converts the velocity energy to pressure energy.

B. Diffuser Case
See Figure 1.

(1) The main structural member of this section is the steel diffuser case. The forward part of this case houses the rearmost portion of the rear compressor.

(2) The exit stator assembly is bolted to flanges in the front openings of the diffuser case. This unit contains an inner shroud, outer shroud and small vanes brazed in place.

(3) Located in the divergent section of the case are nine hollow struts having small circular openings on either side which supply compressor discharge air to a manifold around the diffuser case. The manifold provides the discharge air for anti-icing and airframe use through two ports (upper left and upper right) on its outer perimeter.

(4) Between the nine hollow struts, located radially near the rear of the case are nine fuel nozzle support mounting pads. Behind the mounting pads are nine mounting lugs for the front of the individual combustion chamber.

(5) The pressure sensing boss is located at approximately the 2 o'clock position on the right side outer surface of the diffuser case. Locknuts are incorporated on the rear face of the intermediate front flange and gangnuts are riveted to the inner rear flange to facilitate assembly and disassembly.

C. No. 4 Bearing Compartment and No. 4 Bearing Seal Air System

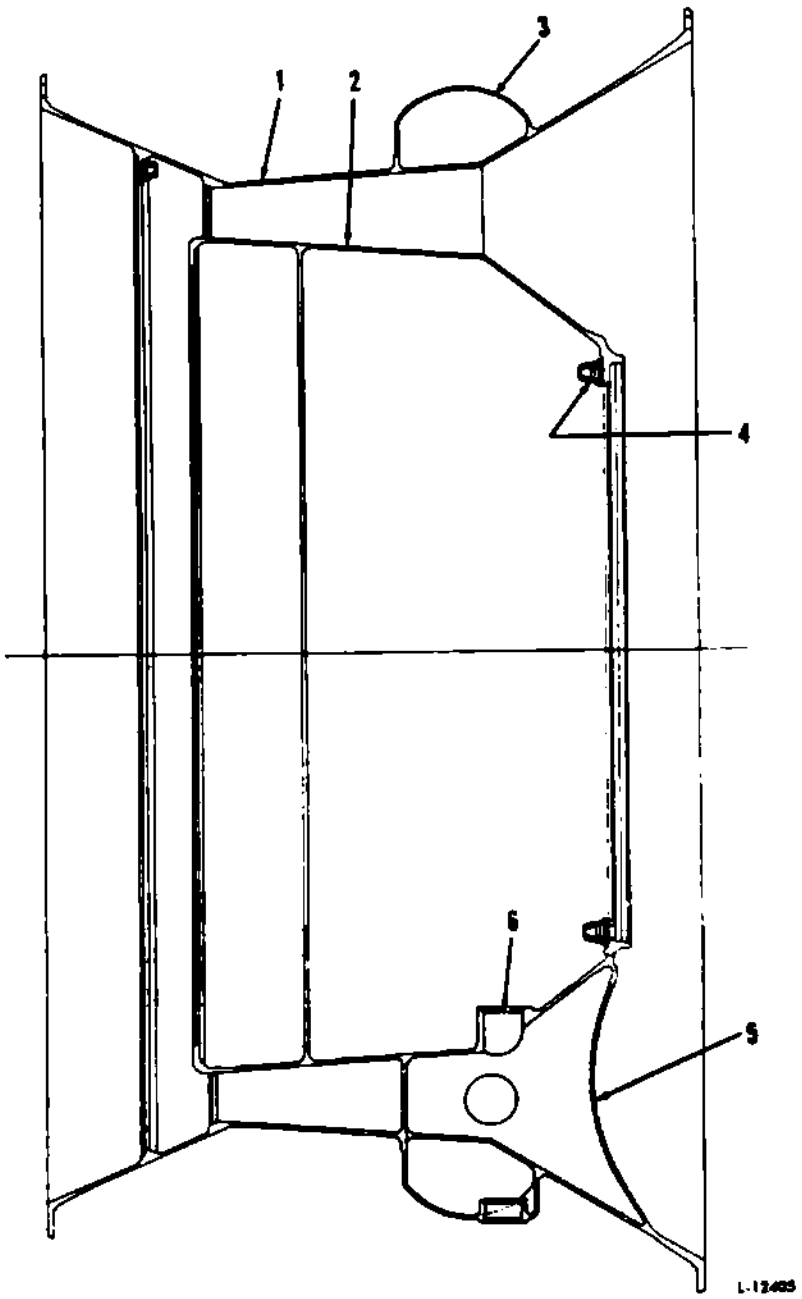
(1) The compartment houses the No. 4 bearings in its ID positioned bearing support. Heatshields are bolted and lockwired in front of the No. 4 bearing compartment to minimize the temperature within. In addition, a tubing system brings eighth stage discharge air to the annulus between the second and third labyrinth seal units, and bleeds air from the annulus between the first and second labyrinth units to the fan discharge path. The tubes, secured to the openings in the No. 4 bearing airseal ring assembly, hold down the bearing compartment temperature by bleeding hot air before it can reach the compartment. Except for engines not incorporating SB 3178, the number 4 bearing seal is equipped with a centrifugal dirt separator.

D. No. 4 and 5 Bearings Oil Scavenge Pump

(1) The No. 4 and 5 bearings oil scavenge pump assembly located inside the diffuser case has two stages driven by a gear mounted on the rear compressor rear hub.

E. No. 4 Bearing Housing

(1) Positioned in the center of the diffuser case, within the bearing compartment, is the No. 4 bearing housing. The No. 4 bearing outer races are held in the ID bore of the housing by a large retaining nut, riveted in place. The rear portion of the housing encloses No. 4 and No. 5 bearing oil scavenge pump.



Diffuser Case Construction
Figure 1
(Task 72-37-00-990-001)

DIFFUSER SECTION - DESCRIPTION-00

1. Outer Diffuser Case
2. Inner Diffuser Case
3. Diffuser Case Air Manifold
4. No. 4 Bearing Support Bolt Circle
5. Diffuser Case Strut
6. No. 4 Bearing Air Bleed Tube Opening

Key to Figure 1

R Task 72-38-01-220-001:

R 1. Diffuser Outer Fan Duct - Inspection

A. Circumferential Cracks

(1) Inspect diffuser outer fan duct for circumferential cracking between 13th stage bleed bosses and Flange H. Total crack length of 10 inches or less may be stop drilled and continued in service without restriction provided following limits are met.

(a) Any one crack does not exceed 5 inches in length.

(b) Cracks are stop drilled using 1/8 (0.125) inch diameter drill.

(2) Cases which exhibit a crack in excess of 5 inches but not exceeding 10 inches may be stop drilled as above and continued in service provided they are reinspected at regular intervals not to exceed 100 hours.

(3) Cases with a crack or total crack length exceeding 10 inches may be stop drilled as above and continued in service for an additional 50 hours prior to removal.

(4) Multiple stop drilling of cracks is permitted provided above criteria are met.

R (5) Repair all cracked cases by Task 72-38-01-300-002,
R (Repair-00).

B. Duct Outer Wall Wear

(1) Worn areas on the diffuser outer fan duct outer wall are permitted if:

(a) All sharp edges and impressions are removed by blend repair.

(b) The maximum depth of the worn area is not more than 0.035 inch after blend repair.

(c) The width-to-depth ratio of the worn area is 12:1 or more after blend repair.

(d) The total area worn to a depth of more than 0.015 inch is not more than 16 inch^2.

(e) Local fluorescent penetrant inspection (SPOP 70) must not find cracks in the duct.

(f) The cause of the worn areas on the duct is removed.

R (g) Repair the duct by Task 72-38-01-300-002,
R (Repair-00.

R DIFFUSER OUTER FAN DUCT - REPAIR-00

R Task 72-38-01-300-002:

R 1. Outer Duct Crack And Indentation Repair

R A. Blend Repair

R NOTE: This repair is for dents 0.015 inch deep maximum.

R (1) Blend repair the damaged area by SPOP 533. Refer to
R Standard Practices, Task 70-00-00-380-002, Section
R 70-00-00, (Repair-02).

R (2) Do a fluorescent penetrant inspection of the blended
R area by SPOP 70, normal sensitivity. Refer to Standard
R Practices, Task 70-00-00-230-001, Section 70-00-00,
R (Inspection/Check-01).

R (3) Do an anodize touch-up of bare surfaces by SPOP 42.
R Refer to Standard Practices,Task 70-00-00-380-010,
R Section 70-00-00 (Repair-10).

R NOTE: Do a patch repair on duct walls that show sharp
R dents which break or crack the duct wall or have
R an indentation with corners less than 0.062 inch
R radius or indentations that are more than 0.015
R inch deep.

R B. Crack Repair (Cracks 5 Inches Long Maximum)
R See Figure 801.

R (1) Repair cracks five inches long maximum by one of the
R methods shown:

R (a) Stop Drill Procedure

R 1 Stop drill cracks five inches long maximum in
R the outer duct with a 0.1875 inch diameter
R drill. Drill a hole at each end of the crack.

R 2 Do a periodic inspection at 100 cycle
R intervals.

R (b) Patch Repair

R NOTE: Before a patch is installed, make sure that
R the patch will not cause a blockage of
R engine or aircraft external hardware.

R DIFFUSER OUTER FAN DUCT - REPAIR-00

R 1. Cut out the damaged area in the duct with a
R circle five inches diameter maximum. The
R circle must remove all of the crack or
R indentation.

R 2. Make patches of 6061 T6 aluminum alloy 0.062
R inch thick, and cut the patch to shape as shown
R in the figure.

R 3. Bend the patch to have as good a fit as
R possible to the contour of the duct. Attach
R the patch tightly in position on the duct.

R 4. Transfer drill rivet holes for rivets,
R reference Cherry rivet PN CR-2249-4-3 or
R equivalent.

R NOTE: Rivet length and quantities will be
R different at each patch location, but
R rivets must not be more than one and
R one-half inches apart.

R 5. Remove the patch and remove burrs from the
R holes.

R 6. Clean the bond surfaces by SPOP 208, local
R wipe method. Refer to Standard Practices,
R Task 70-00-00-100-004, Section 70-00-00,
R (Cleaning-04).

R 7. Apply PWA 36003-2 sealant or PWA 457 epoxy
R resin to the inner surface of the patch
R as shown approximately 0.015 - 0.040 inch
R thick. Refer to Standard Practices,
R Task 70-00-00-400-003, Section 70-00-00,
R (Removal/Installation-03).

R 8. Put the patch in position on the duct and apply
R some standard sheet metal fasteners to attach
R the parts together for initial riveting.
R Install and compress sufficient rivets to hold
R the patch in position.

R 9. Remove the sheet metal fasteners. Install and
R compress the remaining rivets. Examine the
R rivets to make sure that they are tight.

R 10. Cure the PWA 36003-2 or PWA 457 epoxy resin.

R 11. Do an anodize touch-up of bare surfaces by SPOP 42. Refer to Standard Practices, Task 70-00-00-380-010, Section 70-00-00, (Repair-10).

R 12. Record in the engine log that inspection of the patch repair is necessary at the subsequent shop visit to make sure that the rivets are tight and that cracks did not extend.

R C. Crack Patch Repair (Cracks 10 Inches Long Maximum)
R See Figure 802.

R NOTE: Use a patch repair on a duct that shows sharp dents which break or crack the duct wall or produce an indentation with corners less than 0.062 inch radius or indentations that are deeper than 0.015 inch. There is no limit to the number of large patches or small plates used, but the total number of patches must not be more than ten for each duct.

R NOTE: This is applicable to circumferential cracks ten inches long maximum and to all axial cracks (no length limit), except those that end five inches or less from the case flange.

R NOTE: Before a patch is installed, make sure that the patch will not cause a blockage of engine or aircraft external hardware.

R (1) Stop drill the crack ends with a 0.1875 inch diameter drill.

R (2) Use an AMS 4037 patch that is 0.059 - 0.065 inch thick. Cut the patch to shape as shown in the figure.

R (3) Drill rivet holes in the patch for the rivets, reference Cherry rivet PN CR-2249-4-3 or equivalent. Remove all burrs from the holes.

R (4) Bend the patch to have as good a fit as possible with the contour of the duct. Attach the patch tightly in position on the duct.

(5) Transfer drill the rivet holes to the duct. Remove the patch and remove all burrs from the holes.

NOTE: The number of rivets necessary and the size of the patches will increase or decrease with the length of the crack. See Figure 802 for the rivet pattern requirements.

(6) Clean the bond surfaces by SPOP 208, local wipe method. Refer to Standard Practices, Task 70-00-00-100-004, Section 70-00-00, (Cleaning-04).

(7) Apply PWA 36003-2 sealant or PWA 457 epoxy resin to the inner surface of the patch as shown approximately 0.015 - 0.040 inch thick. Refer to Standard Practices, Task 70-00-00-400-003, Section 70-00-00, (Removal/Installation-03).

(8) Put the patch in position on the duct and apply some standard sheet metal fasteners to attach the parts together for initial riveting. Install and compress sufficient rivets to hold the patch in position.

(9) Remove the sheet metal fasteners. Install and compress the remaining rivets. Examine the rivets to make sure that they are tight.

(10) Cure the PWA 36003-2 sealant.

(11) Do an anodize touch-up of bare surfaces by SPOP 42. Refer to Standard Practices, Task 70-00-00-380-010, Section 70-00-00, (Repair-10).

D. 13th Stage Bleed Boss Patch Repair
See Figure 803.

(1) Do a patch repair of circumferential cracks between the 13th stage bleed boss and the front flange as follows:

(a) Stop drill the crack ends with a 0.1875 inch diameter drill.

(b) Cut the patch (PN 706049 or 820103) as shown. Adjust the patch length where necessary for the crack length. Make a chamfer on the leading edge to make a smooth airflow as shown in the figure.

R DIFFUSER OUTER FAN DUCT - REPAIR-00

R (c) Drill rivet holes in the patch for the rivets, reference Cherry rivet PN CR-2249-4-3 or equivalent. Remove all burrs from the holes.

R (d) Bend the patch to have as good a fit as possible with the contour of the duct. Attach the patch tightly in position on the duct.

R (e) Transfer drill the rivet holes to the duct. Remove the patch and remove all burrs from the holes.

R NOTE: The number of rivets necessary and the size of the patches will increase or decrease with the length of the crack. See Figure 803 for the rivet pattern requirements.

R (f) Clean the bond surfaces by SPOP 208, local wipe method. Refer to Standard Practices, Task 70-00-00-100-004, Section 70-00-00, (Cleaning-04).

R (g) Apply PWA 36003-2 sealant or PWA 457 epoxy resin to the inner surface of the patch as shown approximately 0.015 - 0.040 inch thick. Refer to Standard Practices, Task 70-00-00-400-003, Section 70-00-00, (Removal/Installation-03).

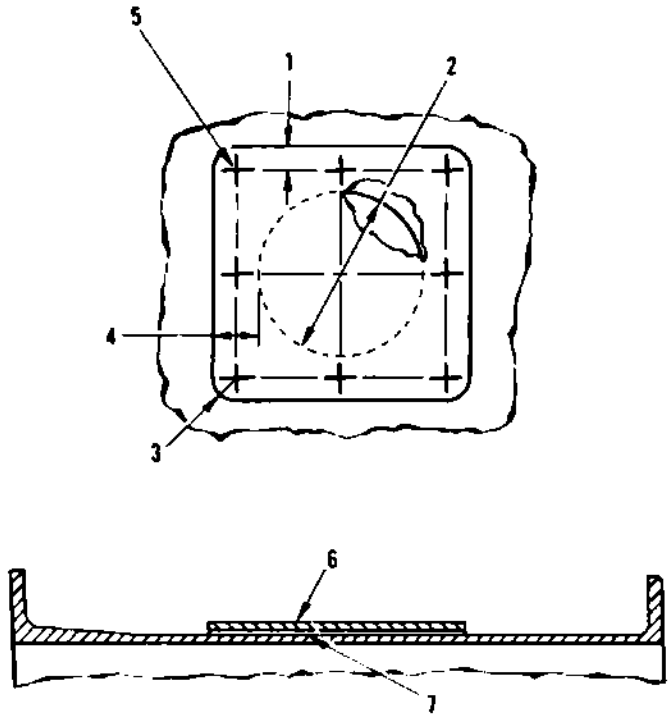
R (h) Put the patch in position on the duct and apply some standard sheet metal fasteners to attach the parts together for initial riveting. Install and compress sufficient rivets to hold the patch in position. The manfactured rivet head must be on the same side as the patch.

R (i) Remove the sheet metal fasteners. Install and compress the remaining rivets with the manufactured rivet head on the same side as the patch. Examine the rivets to make sure that they are tight and have the correct form.

R (j) Cure the PWA 36003-2 sealant.

R (k) Do an anodize touch-up of bare surfaces by SPOP 42. Refer to Standard Practices, Task 70-00-00-380-010, Section 70-00-00, (Repair-10).

R DIFFUSER OUTER FAN DUCT - REPAIR-00

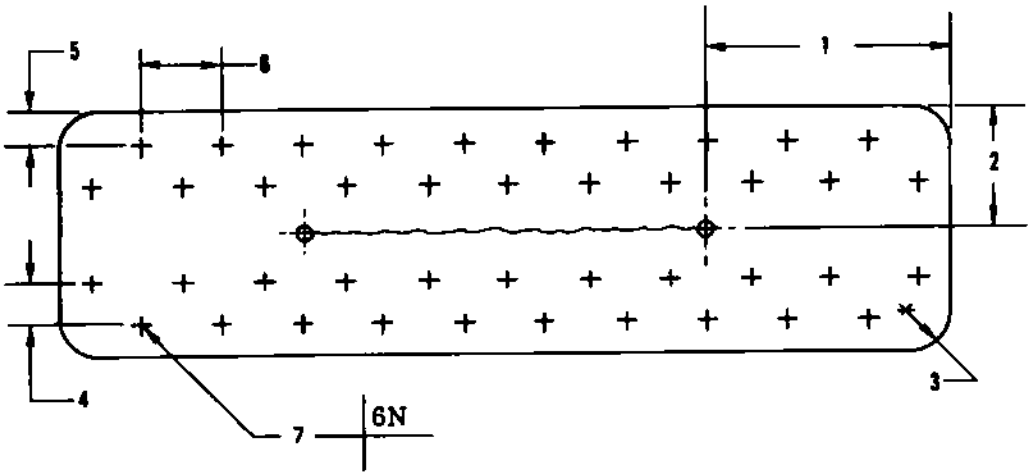


L-H6744 (0204)

R 1. 0.280 Inch. Four Places
R 2. 5.000 Inch Diameter Maximum Hole To Repair Cracks Or
R Indentations.
R 3. 0.250 - 0.281 Inch Radius. Chamfer 0.100 - 0.120 Inch X 45°
R Four Places
R 4. 0.560 Inch Minimum. Machine Index 6 Patch To This Dimension
R To Get The Smallest Possible Patch.
R 5. Rivet Eight Places For Each Patch Maximum; Four Places For Each
R Patch Minimum. 40 Places Maximum Where Necessary.
R 6. Reference Patch
R 7. Apply Adhesive Five Places Maximum Where Necessary.

R Duct Patch Repair (Cracks
R 5 Inches Maximum)
R Figure 801
R (Task 72-38-01-300-002)

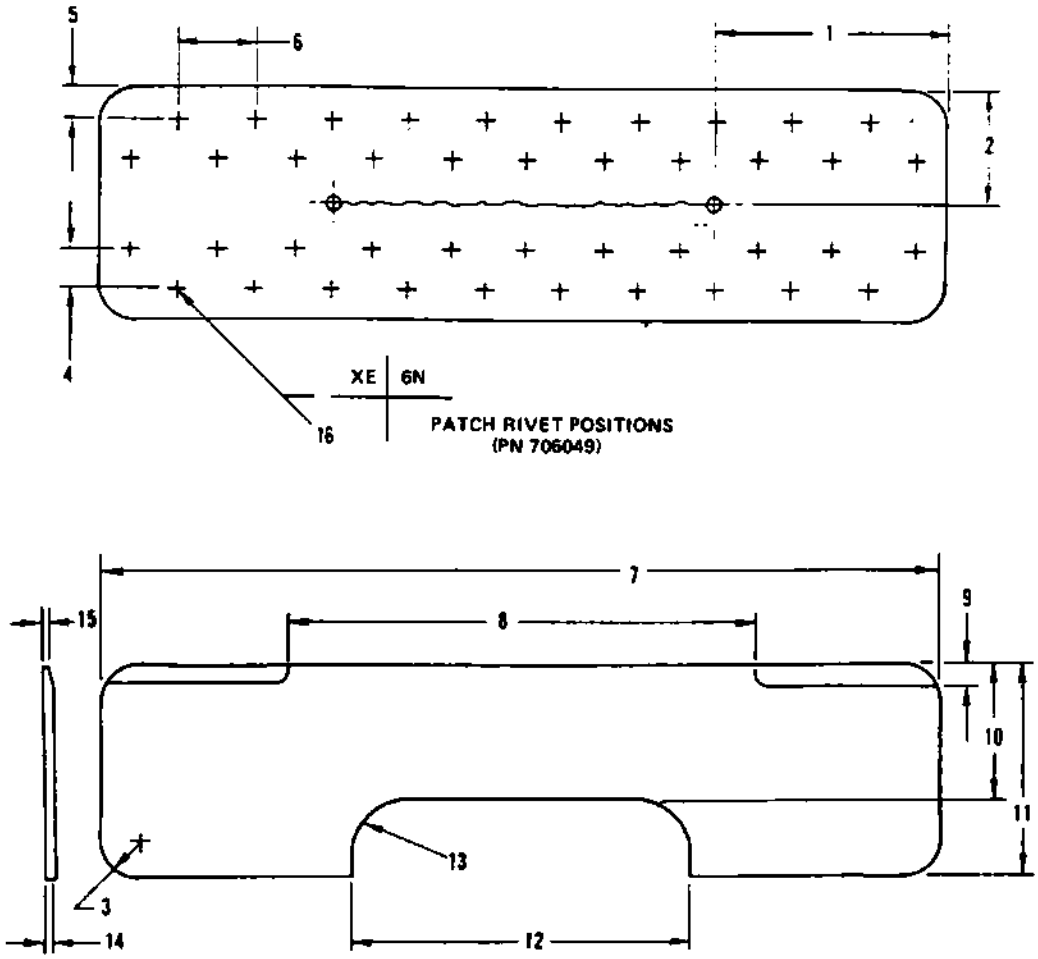
R DIFFUSER OUTER FAN DUCT - REPAIR-00



L-H6745 (0204)

R 1. 3.000 Inches ± 0.062, Two Sides
R 2. 1.500 Inches ± 0.062, Two Sides
R 3. 1.000 Inch Radius ± 0.062, Four Places
R 4. 0.500 Inch Maximum
R 5. 0.400 Inch Minimum
R 6. 0.560 Inch Minimum; 1.100 Inch Maximum
R 7. Cherry Rivet PN CR3223-6-3 Or Equivalent

R Duct Patch Repair (Cracks
R 10 Inches Maximum)
R Figure 802
R (Task 72-38-01-300-002)


5
6
1
2
4
16
XE
6N
PATCH RIVET POSITIONS
(PN 706049)
7
9
15
8
10
11
13
3
14
12
TRIMMING PN 706049 PATCH TO
FIT BOSS CONTOUR

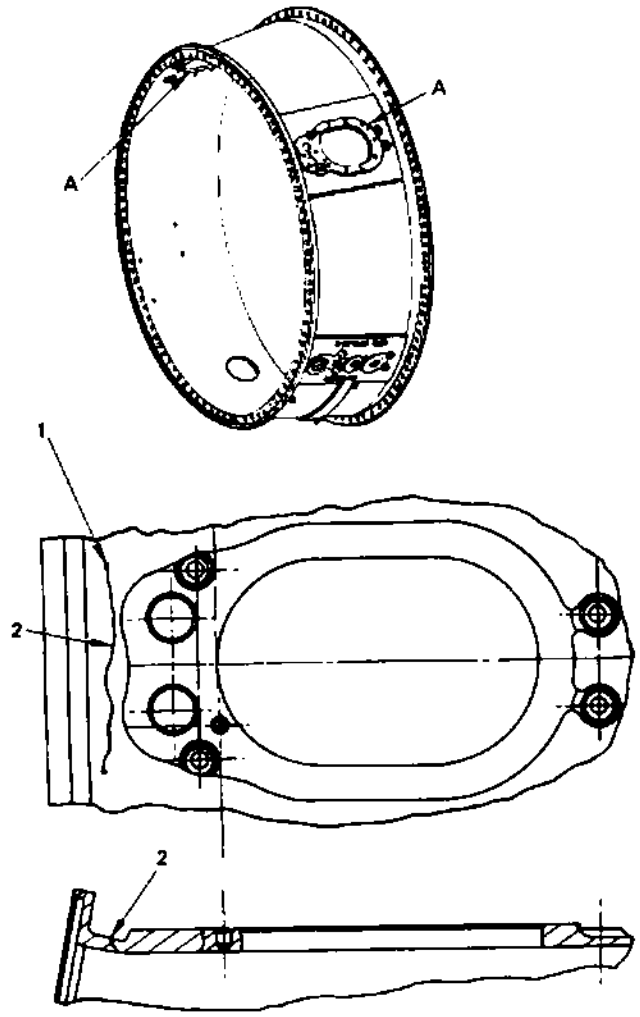
L-H6746 (0204)

R DIFFUSER OUTER FAN DUCT - REPAIR-00

R 1. 3.000 Inches ± 0.062, Two Sides
R 2. 1.500 Inches ± 0.062, Two Sides
R 3. 1.000 Inch Radius ± 0.062, Four Places
R 4. 0.500 Inch Maximum
R 5. 0.400 Inch Minimum
R 6. 0.560 Inch Minimum, 1.100 Inches Maximum
R 7. Adjust Length Where Necessary. Chamfer Front Edge Of Patch For A
R Smooth Airflow.
R 8. 4.000 Inches ± 0.062
R 9. 0.187 Inch ± 0.062
R 10. 1.000 Inch ± 0.062
R 11. 1.750 Inches ± 0.062
R 12. 3.000 Inches ± 0.062
R 13. 0.625 ± 0.062 Inch Radius
R 14. 0.059 - 0.065 Inch (PN 706049 Reference)
R 0.097 - 0.103 Inch (PN 820103 Reference)
R 15. 0.025 Inch Minimum
R 16. Cherry Rivet PN CR3223-6-3 Or Equivalent

R Key to Figure 803 (Sheet 1)

R DIFFUSER OUTER FAN DUCT - REPAIR-00



SECTION AT A
(TYPICAL 2 PLACES)

L-H6747 (0204)

R 1. Stop Drill, Both Ends Of Crack
R 2. Circumferential Body Crack Between 13th Stage Bleed Boss
R And Front Flange.

R Thirteenth Stage Bleed Boss Patch
R Figure 803 (Sheet 2)
R (Task 72-38-01-300-002)

Task 72-40-00-990-001:

1. Combustion Section

A. General

(1) In the combustion section, fuel is mixed with air at the proper ratio, and the resultant fuel/air mixture is burned, adding energy to the air passing through the engine. The fuel is routed through left and right semi-circular manifolds secured around the outside of the diffuser case at the rear. Nine individually supported nozzles inside the diffuser case deliver fuel into the combustion chambers.

B. Combustion Chamber Inner Case

(1) The combustion chamber inner case is secured to the diffuser case inner rear flange and to the outer flange of the No. 5 bearing housing. It forms the inner wall of the combustion chamber and serves to position the No. 5 bearing through the bearing housing.

C. Combustion Chamber Rear Support and Outlet Ducts
See Figure 1.

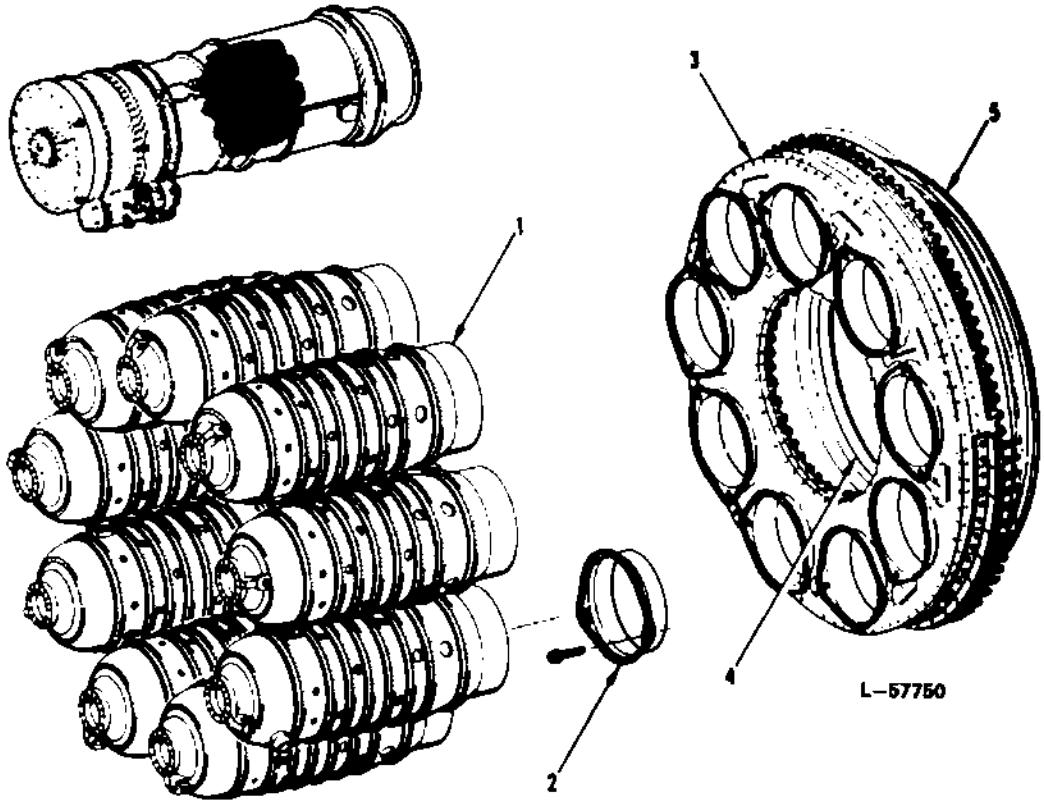
(1) Positioned inside the rear of the combustion chamber area is a welded combustion chamber rear support. This large circular plate has nine openings around a single larger central opening, and holds the rear of the individual combustion chambers in place. The rear outer flange is equipped with bolts held to the support by stops and rivets.

(2) Fitted behind the support are the combustion chamber inner and outer outlet ducts which feature air deflector ducts which divide the cooling air in both the inner and outer duct into two streams. The hot gases pass through the nine support openings and are guided to the first stage nozzle between the outlet ducts.

D. Turbine Shafts and No. 4 1/2 Bearing Heatshields
See Figure 2.

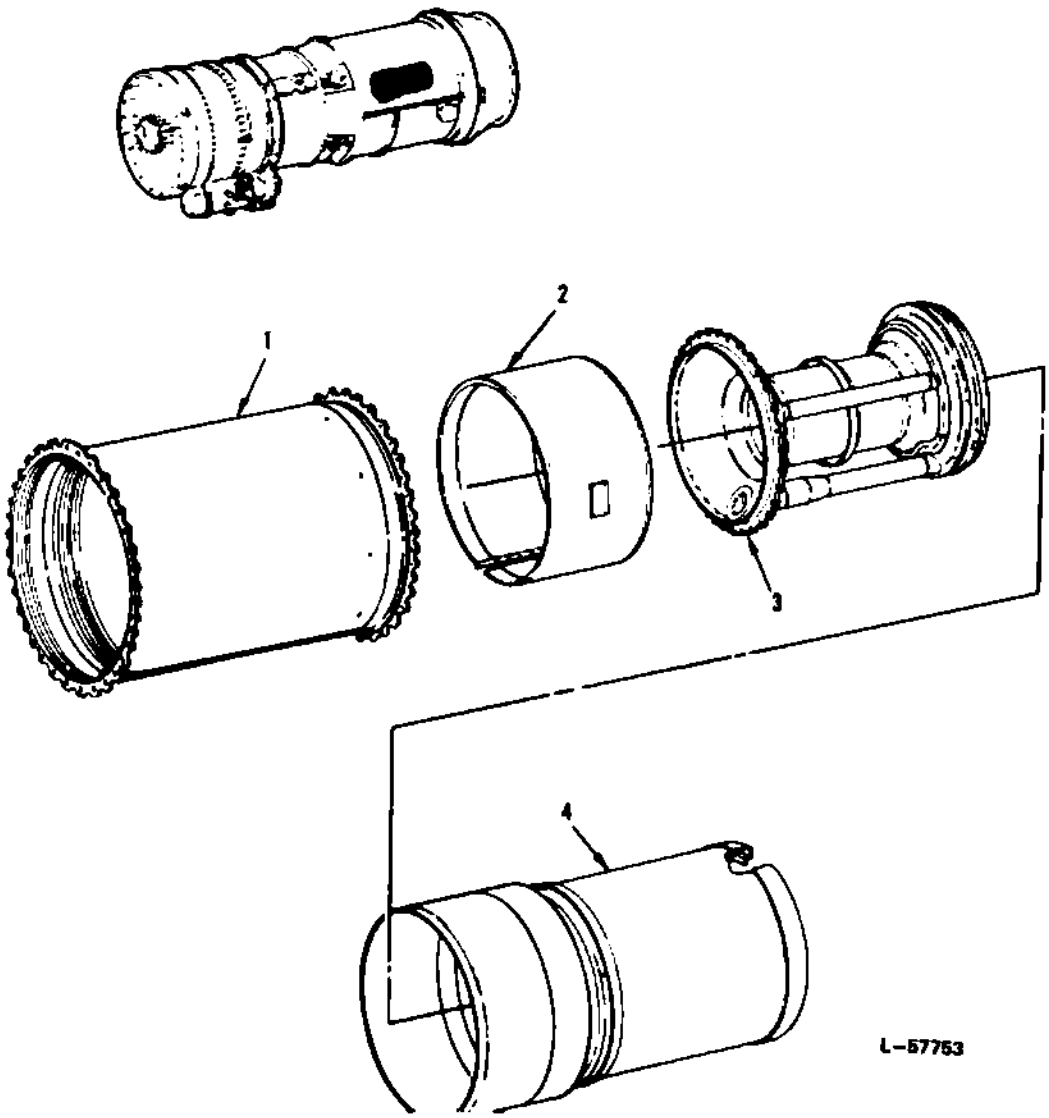
(1) Located within the combustion chamber inner case and bolted to the rear of the No. 4 bearing support are the turbine shafts heatshields. The oil scavenge pump shield is cylindrical in shape and is held in place by the same bolts holding No. 4 1/2 bearing heatshield assembly inside it.

(2) The No. 4 1/2 bearing heatshield assembly is equipped with support tubes around its OD and has a reinforced wasp-waist shape. It is designed to accommodate axial movement of the bearing supporting structure. Self-locking nuts are riveted to the rear flange. A pin in the rear flange and an offset hole in the front flange ensure correct positioning in the engine.



1. Combustion Chambers
2. Combustion Chamber Guide (Nine Required)
3. Combustion Chamber Duct Assembly
4. Combustion Chamber Outlet Inner Duct
5. Combustion Chamber Outlet Outer Duct

Combustion Chambers and
Combustion Chamber Duct Assembly
Figure 1
(Task 72-40-00-990-001)



1. Combustion Chamber Inner Case
2. No. 4 and 5 Bearing Heatshield
3. No. 4 and 5 Bearing Inner Shield Assembly
4. No. 4 and 5 Bearing Outer Heatshield Assembly

Turbine Shafts and No. 4
1/2 Bearing Heatshields
Figure 2
(Task 72-40-00-990-001)

Task 72-40-00-420-001:

1. Removal/Installation Combustion Section Parts

NOTE: Procedural instructions given under this heading are written in sequence allowing for complete disassembly of hot section. It is assumed that when the necessary repair and/or inspection point is reached there need be no further disassembly.

A. Removal of Combustion Section Fan Duct

CAUTION: THE REQUIREMENT TO PROVIDE EXTERNAL SUPPORT FOR EXHAUST DEVICES EXISTS WHENEVER MAXIMUM OVERHANG MOMENT ABOUT FLANGE M (TAILPIPE ATTACHMENT FLANGE) EXCEEDS A MOMENT OF 2500 POUND-INCHES OR MAXIMUM SHEAR LOAD OF 250 POUNDS WHILE COMBUSTION SECTION FAN DUCT AND COMBUSTION CHAMBER CASE ARE DETACHED FOR HOT SECTION MAINTENANCE. DETACHMENT OF THESE UNITS WITHOUT PROPER SUPPORT COULD RESULT IN DAMAGE TO FAN EXHAUST LINK STRUTS IN REAR MOUNT PLANE AND POSSIBLE MISALIGNMENT BETWEEN FAN EXHAUST DUCT AND NO. 6 BEARING SUPPORT. HOT SECTION MAINTENANCE WILL THEREFORE NECESSITATE USE OF EXTERNAL SUPPORT OTHER THAN ENGINE MOUNTING PROVISIONS WHENEVER REVERSER IS IN POSITION.

(1) Remove any interfering airframe parts.

(2) Mark location of clips and brackets on flanges J, J1, K, and side flanges of combustion section fan discharge duct.

(3) Unfasten clips, then remove thermocouple cable from duct as necessary.

CAUTION: DO NOT STEP OR STAND ON THE FAN DISCHARGE DUCTS.

(4) Disconnect and remove No. 6 bearing external oil pressure tube as necessary.

WARNING: BECAUSE VOLTAGE AT IGNITER PLUGS IS DANGEROUSLY HIGH, IGNITION SWITCH MUST BE IN "OFF" POSITION AND IGNITION SYSTEM INOPERATIVE FOR AT LEAST SEVERAL MINUTES BEFORE COUPLING NUTS THAT SECURE CABLES TO IGNITER PLUGS ARE REMOVED. SEE CHAPTER 74,

IGNITION, FOR SPECIAL PRECAUTIONS INVOLVED WITH IGNITION SYSTEM.

(5) Disconnect igniter plug leads and remove packing holders and igniter plugs.

NOTE: Ignition exciter may be left attached to lower duct. If exciter is removed and brackets are removed from lower fan duct, retaining screws attaching brackets to flange must be torqued at assembly according to Reference 1031 (Section 72-00, Removal/Installation).

(6) Remove bolts and remove fuel drain manifold packing holder from bottom of combustion section fan duct. (Remove two packing holders for engines so equipped.)

(7) Remove nuts and bolts from sides and ends of combustion section upper duct, then remove it from engine.

CAUTION: USE CARE TO AVOID DAMAGE TO FUEL DRAIN MANIFOLD AT BOTTOM OF COMBUSTION CHAMBER OUTER CASE.

(8) Remove nuts and bolts from ends of lower duct. Carefully lower duct to clear two drain tube connectors (or fuel drain manifold as equipped) and remove from engine.

B. Moving Combustion Chamber Outer Case Rearward

(1) Unfasten bolts and remove left igniter cable fairing from eight o'clock position of fan duct.

(2) If engine is equipped with fan duct diffuser strap, remove screws from strap, then remove strap from diffuser case rear flange.

(3) Remove screws and nuts from diffuser case rear flange.

NOTE: Duct segments incorporating SB 5502 feature tool access cutouts to facilitate access to front combustion chamber case bolts.

(4) Remove fan discharge turbine section inner duct halves.

(a) For JT8D-1,-1A,-1B,-7,-7A,-7B,-9,-9A,-11,-17,-17A engines with double noise attenuation equipment and engines incorporating SB 3781, two band segments bolted onto gang nut assembly at rear flange of turbine nozzle rear case secure rear edge of fan discharge turbine inner duct. These must be removed to remove duct. Fan discharge turbine exhaust inner front duct is also attached by same bolts, but may be left hanging on engine.

(b) On engine incorporating PN 753814 shield segments, remove bolts securing turbine exhaust inner front duct. These bolts also retain turbine case shield inside bracket at rear of turbine nozzle case. Prevent turbine case shield from slipping out of bracket as inner front duct bolts are removed; unscrew and remove shield halves as access permits.

(c) Remove bolts which secure inner duct halves together and from gangnut assemblies at rear of combustion chamber outer case. Remove duct halves from engine.

CAUTION: USE ONLY HAND TOOLS WHEN REMOVING OUTER CASE FRONT AND REAR FLANGE NUTS.

(5) Unfasten locknuts from combustion chamber outer case rear flange and remove gangnut assemblies.

(6) Install PWA 12044 Collar around outer case.

(7) Support case by collar.

(8) Remove six jackscrew plugs from rear flange of combustion chamber outer case and jack case free from snap diameter of turbine nozzle case.

(9) Carefully move combustion chamber outer case rearward, as far as it will go, making certain that it does not bump burner cans.

C. Combustion Chambers - Removal
See Figure 401.

(1) Remove lockwire from rear guide retaining bolts, crossover tube bolts, and combustion chamber mount pins and bolts.

(2) Loosen and remove above nuts and bolts.

(3) Remove combustion chamber positioning pins from front of each chamber (remove pin locks, if slanted-pin type).

NOTE: If slanted-type pin is tight in combustion chamber mounting lug and difficult to remove, slide jaw of PWA 33536 Puller onto lock groove of pin and pull out pin using knocker hammer on puller.

(4) Slide rear guides forward on chambers until they bottom against diverging portion of chamber rear liner. This must be accomplished before attempting chamber removal.

(5) Move crossover tube of chambers No. 6 and 7 back and remove chamber No. 5. In order to obtain sufficient clearance, shift and slant chambers No. 6 and 7 toward diffuser case strut to allow removal of chamber No. 5.

NOTE: Slant all chamber assemblies in same direction to facilitate removal.

(6) Remove chambers No. 4 and 7 as outlined in steps above and then chambers in following order: No. 8, 9, 1, 2, 3, and 6.

(7) Remove tubes, clamps (if present), and positioning guides.

D. First Stage Turbine Vanes Removal

NOTE: For engines incorporating SB 5021 or SB 5455, and -15A, -17A and -17AR models, see paragraph E. See Figures 402 and 403.

CAUTION: TURBINE NOZZLE AND TURBINE CASES ARE SUPPORTED BY FIRST STAGE TURBINE VANES. MAKE CERTAIN TURBINE CASES ARE ADEQUATELY SUPPORTED IF A SIZEABLE QUANTITY OF VANES IS TO BE REMOVED. THIS MAY BE ACCOMPLISHED BY SUPPORTING TURBINE CASE FROM ABOVE OR FROM BELOW WITH SADDLE ARRANGEMENT AT NECK DOWN SECTION OF CASE. MAKE CERTAIN AIRFRAME SILENCER AND REVERSER ARE REMOVED OR

ADEQUATELY SUPPORTED DURING THIS PHASE OF MAINTENANCE.

(1) Remove bolts holding combustion chamber rear support or duct assembly at its ID.

(2) Slide reinforcing plate (if full-circle type) and rear support or duct assembly forward as far as they will go.

(3) If outlet ducts are of type which is separable from combustion chamber rear support (non-riveted) (see Sheet 1 of Figure 403), proceed as follows:

(a) Disengage combustion chamber outlet inner duct and slide it forward.

NOTE: Certain combustion chamber duct assemblies for JT8D-1,-1A,-1B,-7,-7A,-7B,-9, and -9A have separable (non-riveted) outlet outer duct and integral (riveted) outlet inner duct; inner duct on this assembly type will move forward with combustion chamber rear support.

(b) Disengage combustion chamber outlet outer duct and slide it forward.

(4) Using approved marking method, number 1st stage turbine vanes and their location to ensure their return to same location and mark relationship of turbine nozzle front case to vane position.

(5) Unbolt and remove segmented inner and outer duct rear supports and plate-spacers (if present) holding vanes to be removed.

NOTE: Rear duct supports cover short span of vanes and need only be removed as required.

(6) Pull vane straight out, removing as many as required.

NOTE: When necessary to remove all vanes, 12 or more vanes should be left in (evenly spaced) until sufficient number of new (or serviceable) vanes are installed to prevent cocking of turbine case.

(7) Individual vanes may be replaced, class for class, as required. Replacement vanes must bear same classification as vanes replaced. However, if substantial quantity of vanes are to be replaced, it is good maintenance practice to distribute replacement vanes equally around nozzle area. See Paragraphs F. and G.

E. First Stage Turbine Vanes - Removal (Engines Incorporating SB 5021 or SB 5455 and JT8D-15A,-17A and -17AR). See Figure 404.

(1) Remove bolts at ID of combustion chamber duct assembly and slide duct forward.

NOTE: Vane segments are comprised of 11 vanes at two locations, with adjacent segments of 12 vanes at two locations. Turbine vane platform seals are omitted at four locations between adjacent vane segments. See figure for location of omitted seals between turbine vanes. Vane segments with equal number of vanes are diametrically opposite but are not angularly located to any other feature.

(2) Make determination as to vane or vanes that require replacement and using approved marking method, number 1st stage turbine vanes and their location to ensure their return to same location. Mark relationship of turbine front case to vane position.

CAUTION: PREVENT TURBINE CASES FROM MOVING OUT OF POSITION BY REMOVING AND REINSTALLING VANE SEGMENTS ONE AT A TIME.

(3) If six-hole combustion chamber duct inner rear support requires removal because of proximity to vanes which are to be replaced, mark support position to facilitate return to same location at assembly. Remove bolts at vane inner flange, then remove duct inner rear supports and spacers as necessary.

(4) If six-hole combustion chamber duct outer rear support requires removal because of proximity to vanes which are to be replaced, mark support position to facilitate return to location at assembly. Remove bolts and washers at vane outer flange, then remove duct outer rear supports and combustion chamber seal assemblies as necessary. Remove spacer sleeves.

(5) Temporarily reinsert several vane retaining bolts to prevent vane segments from falling out.

NOTE: Vanes included between two omitted vane platform seal locations constitute 11 or 12 vane segments.

(6) Using 0.002 inch feeler gage, check between adjacent inner and outer vane platforms for omitted stator vane seals.

(7) Release vane segment to be replaced by removing additional inner or outer duct rear supports as necessary.

(8) Install PWA 45226 Fixture over vane segment, with locating dowel pins contacting convex side of vane airfoils at two places (see figure).

(9) Secure fixture to vanes using vane retaining hook assemblies. Dot on each handle ball indicates position of hook; turn all hooks to grasp trailing edges of vanes.

(10) Remove temporary vane retaining bolts, then remove vane segment and fixture from engine and place on workbench.

(11) Loosen hook assemblies and remove vanes and turbine vane inner and outer platform seals from fixture.

F. First Stage Turbine Vanes Installation

NOTE: For engines incorporating SB 5021 or SB 5455 and -15A, -17A and -17AR, see paragraph G.

(1) Make certain 1st stage turbine stator seat is in position in turbine outer case.

NOTE: First state turbine vanes should be numbered clockwise as viewed from REAR with No. 1 vane at top dead center. As installed, OD flange retaining bolt for No. 1 vane is at top dead center and in centerline of No. 1 combustion chamber.

NOTE: Vane area for a model with the specified configuration must be as shown in Tables 401 thru 404. This area is the result of vanes which together have a numerical class average as shown. A maximum range of six classes in a nozzle assembly is permitted. The class range between two adjacent vanes must not be more than three classes.

CONFIGURATION	TOTAL VANE AREA (SQUARE INCHES)	NUMERICAL CLASS AVERAGE (WHOLE CLASSES)	NUMERICAL CLASS AVERAGE (TENTH CLASSES)
53-Vane Type	62.86 - 63.41	7.64 - 7.64	7.64 - 8.64
46-Vane Type Pre-SB 5207	64.446 - 64.998	13.00 - 13.00	13.00 -14.00
46-Vane Type Post-SB 5207	64.446 - 64.998	32.93 - 32.93	32.93 - 33.93
46-Vane Type Pre-SB 5207 and Post-SB 5947 (see NOTE 2)	66.332 - 66.884	16.48 - 16.48	16.48 - 17.48
46-Vane Type Post-SB 5207 and Post-SB 5947 (see NOTE 2)	66.332 - 66.884	36.52 - 36.52	36.52 - 37.52
46-Vane Type With 8th Stage Bleed System (Post-SB 4597 or SB 5425), Pre-SB 5207 and SB 5947 (see NOTE 1)	62.836 - 63.388	10.00 - 10.00	10.00 - 11.00

First Stage Turbine Vane Areas
(JT8D-1,-1A,-1B,-7,-7A,-7B,-9,-9A)
Table 401

CONFIGURATION	TOTAL VANE AREA (SQUARE INCHES)	NUMERICAL CLASS AVERAGE (WHOLE CLASSES)	NUMERICAL CLASS AVERAGE (TENTH CLASSES)
46-Vane Type With 8th Stage Bleed System (Post-SB 4597 or SB 5425), Post-SB 5207 and Pre-SB 5947 (see NOTE 1)	62.836 - 63.338	29.93 - 29.93	29.93 - 30.93
46-Vane Type With 8th Stage Bleed System (Post-SB 4597 or SB 5425), Post-SB 5207 and SB 5947 (see NOTEs 1 and 2)	64.768 - 65.274	33.52 - 33.52	33.52 - 34.52
46-Vane Type With 8th Stage Bleed System (Post-SB 4597 or SB 5425), Post-SB 5947 (see NOTEs 1 and 2)	64.630 - 65.182	14.917 - 14.917	14.917 - 15.917

NOTE: 1: Assembly with a numerical class average of up to three (3) classes larger than shown is permitted if the engine is post-SB 4597 or SB 5425 (8th stage bleed modification)

NOTE: 2: The area shown was necessary for an engine which used the increased area exhaust nozzle specified in SB 5947 Revision 1, 2,3, 4, and 5. It is permitted to operate an engine with the area shown without the increased area nozzle, but because of possible performance losses and disk cycle life losses related to Q Factors, it is recommended that the vane areas be changed back to the pre-SB 5947 Revision 1,2,3,4,and 5 vane class at the next shop visit. (Revision 6 to SB 5947 removes the increased area turbine exhaust nozzle and increased turbine vane area requirements).

First Stage Turbine Vane Areas
(JT8D-1,-1A,-1B,-7,-7A,-7B,-9,-9A)
Table 401 (Continued)

CONFIGURATION	TOTAL VANE AREA (SQUARE INCHES)	NUMERICAL CLASS AVERAGE (WHOLE CLASSES)	NUMERICAL CLASS AVERAGE (TENTH CLASSES)
Pre-SB 5297	64.446 - 64.998	13.00 - 13.00	13.00 - 14.00
Post-SB 5297	64.446 - 64.998	32.93 - 32.93	32.93 - 33.93
Pre-SB 5297 and Post-SB 5947 (see NOTE 2)	66.332 - 66.884	16.48 - 16.48	16.48 - 17.48
Post-SB 5297 and Post-SB 5947 (see NOTE 2)	66.332 - 66.884	36.52 - 36.52	36.52 - 37.52
With 8th Stage Bleed System (Post-SB 4597 or SB 5425), Pre-SB 5207 and SB 5947 (see NOTE 1)	62.836 - 63.388	10.00 - 10.00	10.00 - 11.00
With 8th Stage Bleed System (Post-SB 4597 or SB 5425), Post-SB 5207 and Pre-SB 5947 (see NOTE 1)	62.836 - 63.388	29.93 - 29.93	29.93 - 30.93
With 8th Stage Bleed System (Post-SB 4597 or SB 5425), Post-SB 5207 and SB 5947 (see NOTEs 1 and 2)	64.768 - 65.274	33.52 - 33.52	33.52 - 34.52

First Stage Turbine
Vane Areas (JT8D-11)
Table 402

CONFIGURATION	TOTAL VANE AREA (SQUARE INCHES)	NUMERICAL CLASS AVERAGE (WHOLE CLASSES)	NUMERICAL CLASS AVERAGE (TENTH CLASSES)
With 8th Stage Bleed System (Post-SB 4597 or SB 5425), Post-SB 5947 (see NOTEs 1 and 2)	64.630 - 65.182	14.917 - 14.917	14.917 - 15.917

NOTE: 1: Assembly with a numerical class average of up to three (3) classes larger than shown is permitted if the engine is post-SB 4597 or SB 5425 (8th stage bleed modification)

NOTE: 2: The area shown was necessary for an engine which used the increased area exhaust nozzle specified in SB 5947 Revision 1, 2,3, 4, and 5. It is permitted to operate an engine with the area shown without the increased area nozzle, but because of possible performance losses and disk cycle life losses related to Q Factors, it is recommended that the vane areas be changed back to the pre-SB 5947 Revision 1,2,3,4,and 5 vane class at the next shop visit. (Revision 6 to SB 5947 removes the increased area turbine exhaust nozzle and increased turbine vane area requirements).

First Stage Turbine
Vane Areas (JT8D-11)
Table 402 (Continued)

CONFIGURATION	TOTAL VANE AREA (SQUARE INCHES)	NUMERICAL CLASS AVERAGE (WHOLE CLASSES)	NUMERICAL CLASS AVERAGE (TENTH CLASSES)
JT8D-15 Pre-SB 4847	65.27 - 65.84	34.50 - 34.50	34.50 - 35.50
JT8D-15 Post-SB 4847	64.446 - 64.998	32.93 - 32.93	32.93 - 33.93
JT8D-15 Pre-SB 4847 and Post-SB 5947*	67.163 - 67.749	38.14 - 38.14	38.14 - 39.14

First Stage Turbine Vane
Areas (JT8D-15,-17,-17R)
Table 403

CONFIGURATION	TOTAL VANE AREA (SQUARE INCHES)	NUMERICAL CLASS AVERAGE (WHOLE CLASSES)	NUMERICAL CLASS AVERAGE (TENTH CLASSES)
JT8D-15 Post-SB 4847 and Post-SB 5947*	66.332 - 66.884	36.52 - 36.52	36.52 - 37.52
JT8D-17, -17R	65.10 - 65.66	34.19 - 34.21	34.21 - 35.21

*The area shown was necessary for an engine which used the increased area exhaust nozzle specified in SB 5947 Revision 1, 2,3, 4, and 5. It is permitted to operate an engine with the area shown without the increased area nozzle, but because of possible performance losses and disk cycle life losses related to Q Factors, it is recommended that the vane areas be changed back to the pre-SB 5947 Revision 1,2,3,4,and 5 vane class at the next shop visit. (Revision 6 to SB 5947 removes the increased area turbine exhaust nozzle and increased turbine vane area requirements).

First Stage Turbine Vane
Areas (JT8D-15,-17,-17R)
Table 403 (Continued)

CONFIGURATION	TOTAL VANE AREA (SQUARE INCHES)	NUMERICAL CLASS AVERAGE (WHOLE CLASSES)	NUMERICAL CLASS AVERAGE (TENTH CLASSES)
All	65.78 - 66.33	29.00 - 29.00	29.00 - 30.00

NOTE: PN 794491 and PN 784371 Vanes may be intermixed in one engine assembly. If vanes are intermixed, install PN 794491 Vanes in normally hot spots behind combustion chambers.

First Stage Turbine Vane
Areas (JT8D-15A,-17A,-17AR)
Table 404

(2) Insert vanes individually into their grooves, aligning vane holes with boltholes in turbine nozzle inner and outer cases.

NOTE: Be sure vanes are fully seated and make certain correct numbered vane is returned to its original position.

CAUTION: IN FOLLOWING STEP ENSURE THAT PLATE SPACERS ARE INSTALLED FORWARD OF VANE OUTER FOOT. CURRENT SPACER SETS HAVE POSITIONING LUGS (SEE FIGURE 403) ON ONE OF SEGMENTS TO PREVENT INCORRECT INSTALLATION.

(3) Align plate spacers (if used) over outer diameter of vane boltholes.

CAUTION: DO NOT USE ANY BOLT THREAD LUBRICANT SUCH AS ENGINE OIL, FEL-PRO, EASE-OFF, ETC. DURING INSTALLATION.

(4) Install inner and outer duct supports in front of vanes and spacers and secure them in place with bolts.

(5) Torque inner and outer vane bolts to Fits and Clearances References 904 and 906 respectively. Lockwire bolts. (For JT8D-15,-17 and -17R see References 101 and 102).

(6) If outlet ducts are of type which is separable from combustion chamber rear support (non-riveted) (see Sheet 1 of Figure 403), proceed as follows:

(a) Slide inner and outer outlet ducts rearward and securely seat them over inner and outer positioning supports respectively.

(b) Slide combustion chamber rear support into position in front of outlet ducts.

(7) If outlet ducts are incorporated in integral (riveted) combustion chamber duct assembly, move duct assembly rearward, seating rearward edges of inner and outer ducts as assembly moves into place. See Sheet 2 of Figure 403.

CAUTION: WHEN CHECKING POSITION OF SEPARABLE-TYPE DUCTS IN FOLLOWING STEP, INSPECT INNER AND OUTER DUCT JOINTS USING A MIRROR TO BE SURE THAT LEADING EDGE OF BOTH DUCTS FITS PROPERLY INTO GUIDES OF COMBUSTION CHAMBER REAR SUPPORT.

(8) Inspect through nine holes of combustion chamber rear support or duct assembly and cooling air holes for proper engagement of support and ducts. See Figure 405.

CAUTION: DO NOT USE ANY THREAD LUBRICANT SUCH AS ENGINE OIL, FEL-PRO, EASE-OFF, ETC. DURING INSTALLATIONS.

(9) Position reinforcing plate or plate segments in front of combustion chamber rear support or duct assembly flange and install bolts. Torque bolts 75 - 85 pound-inches and lockwire.

G. First Stage Turbine Vanes - Installation (Engines Incorporating SB 5021 or SB 5455 and -15A,-17A and -17AR models).
See Figure 404.

(1) Place PWA 45226 Fixture (for 11 or 12 vane segment) on bench support foot down.

NOTE: Vane nozzle area is produced as shown in Tables 401 thru 404.

(2) Place 1st stage turbine vane, leading edge down, on fixture and locate convex side of airfoil against dowel pins adjacent to edge of fixture segment. Position vanes in fixture at same location as originally removed at disassembly.

(3) Install vane platform seals at inner and outer vane platform, on side of vane to contact next vane in segment. Seals at outer ends of segment are omitted.

(4) Install next vane, engaging vane platform seals, and continue until full vane segment has been assembled in fixture.

(5) Secure assembled vane segment in position using vane retaining hooks.

(6) Using support feet as handles, carefully install vane segment in engine and temporarily insert several vane retaining bolts to keep vane segment and fixture in place. Disengage vane hooks from vanes and carefully remove fixture segment.

(7) If required install up to four vane segments in manner specified above, one segment at a time.

NOTE: When installing more than one adjacent vane segment do not position inner or outer combustion chamber duct supports on installed vane segment if supports extend beyond ends of segment as this would prevent installation of an adjacent segment. Install supports when all vane segments have been positioned.

NOTE: Do not apply lubricating oil to vane retaining bolts used at ID and OD of vane platform boltholes before installation.

(8) Remove vane retaining bolts temporarily installed at inner vane flanges. Position spacers in vane flange boltholes. If six-hole combustion chamber duct inner rear support was removed, install support at same location. Install remaining duct inner rear supports. Position vane retaining bolts and handtighten.

(9) Assemble spacer sleeves, seal assemblies, duct supports, washers and vane retaining bolts at outer vane platforms as follows:

(a) Remove vane retaining bolts temporarily installed at outer vane flanges, then position spacer sleeves in vane flange boltholes.

(b) Install combustion chamber seal assemblies over OD vane platforms aligning boltholes. Bend of seals is aft, toward vane feet.

NOTE: Use PN 778586 combustion chamber seal assembly over vane segment containing 11 vanes and PN 778585 seal assembly for vane segment containing 12 vanes.

(c) If six-hole combustion chamber duct outer rear support was removed, install at same location, then install remaining duct outer rear supports. Install bolts and washers and handtighten.

(d) Torque 46 bolts at ID of vane platforms to Fits And Clearances Reference 904. Torque 46 bolts at OD of vane platforms to Fits And Clearances, Reference 906, (For JT8D-15A,-17A and -17AR see References 101 and 102).

NOTE: Do not apply lubricating oil to flange retaining bolts before installation.

(10) Inspect assembled vanes to ensure that vane platform mismatch does not exceed limits per Fits And Clearances, Reference 845, (for JT8D-15A,-17A and -17AR, see Reference 24) for full platform length. No overlaps are permissible. If excessive mismatch is found, replace suspect vanes and hold them for possible repair.

NOTE: Vanes may be shifted circumferentially to meet mismatch limits. Three-class spread of adjacent vanes must not be exceeded.

(11) Move combustion chamber duct assembly rearward then install bolts making sure duct assembly and duct supports are properly engaged. Torque 36 bolts at ID of duct assembly to 75 - 85 lb-in. Torque 4 remaining bolts.

H. Combustion Chamber Installation.
See Figures 401 and 406.

(1) Ensure combustion chamber outer case is moved rearward as far as possible.

CAUTION: VARIOUS COMBUSTION CHAMBER CONFIGURATIONS IN JT8D ENGINES, SUCH AS HARDFACED OR NON-HARDFACED NOZZLES OR CROSSOVER TUBES, FLOATING OR BOLTED INTERCONNECTORS, AND ALTERED AIR HOLE PATTERNS LIMIT INTERCHANGEABILITY OF COMBUSTION CHAMBERS WITHIN SETS, BETWEEN DASH MODELS, OR BETWEEN CONVERTED AND AS MANUFACTURED MODELS. ENSURE COMPATIBILITY OF COMBUSTION CHAMBER IN SET AND ENGINE BEFORE INSTALLATION.

CAUTION: EXAMPLE: FOR JT8D-15 CONVERTED FROM JT8D-9, CONVERTED CHAMBERS AND NEW REPLACEMENT CHAMBERS MUST BE INSTALLED IN COMPLETE

SETS DUE TO CROSSOVER TUBE CONFIGURATION DIFFERENCE.

CAUTION: FIT OF EACH COMBUSTION CHAMBER GUIDE WITH REAR LINER OF COMBUSTION CHAMBER IS CRITICAL TO MINIMIZE MOUNT PIN WEAR. IF SPECIFIED FIT CANNOT BE OBTAINED, ROUTE GUIDE TO OVERHAUL FOR RESIZING.

(2) Install positioning guides over rear OD of nine chamber assemblies, making sure loose fit given in Fits and Clearances, Reference 748, is maintained. Push each guide forward until it bottoms against diverging portion of chamber rear liner. (For JT8D-15,-15A,-17,-17A,-17R and -17AR, see Reference 11).

(3) Install nine crossover tubes on chamber male tubes. Tubes may be taped to hold them in position during installation handling.

(4) With PN 629XXX and prior chambers install nine plastic clearance rings, PWA 15707 Gage, into position on male flame tubes of chambers.

(5) Install combustion chamber No. 6 as follows:

CAUTION: DO NOT DAMAGE FUEL NOZZLES OR BLOCKAGE RING ON CHAMBER FUEL NOZZLE GUIDE DURING INSTALLATION.

(a) Insert forward portion of No. 6 chamber assembly into diverging section of diffuser case between Nos. 6 and 7 fuel nozzles so that chamber rests on diffuser case strut.

(b) Move rear of chamber into ID of combustion chamber rear support flange.

(c) Carefully position chamber assembly on its fuel nozzle. See Fit and Clearances, Reference 745. (For JT8D-15,-15A, -17,-17A,-17R and -17AR, see Reference 58, Section 72-00, Removal/Installation, Engine Assembly "Fits and Clearances").

(6) Position Chamber No. 7 on its fuel nozzle in manner described above. Remove tape from tube if used. Maintain crossover tube in such position to ensure that as chamber assembly is brought onto its fuel nozzle, tube engages in channel formed by mating tube on chamber No. 6.

(7) Install combustion chamber assembly Nos. 8, 9, 1, 2, 3, and 4 in manner described above.

NOTE: Chambers must be installed only in above order.

(8) Position chamber No. 5 on its fuel nozzle in manner described above, shifting other chambers as necessary to allow sufficient clearance.

NOTE: Early combustion chamber sets featured unique chamber at No. 5 location (with modified crossover tube to aid assembly). Assemble these chambers in order prescribed. Newer chamber sets have no unique No. 5 chamber; order of installation is not critical, but follow order prescribed for best results.

CAUTION: MAKE SURE BOLTS ARE INSTALLED SO BOLTHEADS REST AGAINST INTERCONNECTOR TUBE FLANGES, IN ALL 18 LOCATIONS. HOLE DIAMETERS ARE DIFFERENT TO ALLOW FOR CENTERING TUBES, HENCE BOLTS ARE PROVIDED WITH LARGER BEARING SURFACES TO COMPENSATE FOR VARIATIONS.

(9) Install 18 bolts and 18 nuts loosely into crossover tube flanges.

CAUTION: CARELESS USE OF AN ALIGNMENT TOOL DURING COMBUSTION CHAMBER INSTALLATION MAY RESULT IN DAMAGE TO LOCATOR PIN BUSHING.

(10) For JT8D-9,-9A,-11, and -17 engines incorporating SB 4423, install mount pins, PN 694281, and retaining bolts, PN 333205, to secure chambers to diffuser case. Do not tighten at this time. For as manufactured straight-pin type installations, install mount pin and retaining bolts to secure chambers to diffuser case. Do not tighten at this time. For slanted-pin type installations, install grooved lockpins to position chambers in diffuser case. Secure each pin with lock and bolt.

(11) Slide positioning guides rearward into position in rear support assembly. Install, and torque 18 rear guide retaining bolts.

(12) Torque and lockwire pin lock bolts on slanted pin type chambers.

CAUTION: FOR JT8D-11 AND -15 CHAMBERS WITH FLOATING CROSSOVER TUBES PRIOR TO SB 4156, MAKE CERTAIN THAT INTERCONNECTOR TUBE CLAMPS ARE INSTALLED WITH SHIELDED SURFACE ON UPSTREAM (FORWARD) SIDE OF CROSSOVER TUBES TO ENSURE MAXIMUM ALTITUDE RELIGHT CHARACTERISTICS, AND PRECLUDE CROSSOVER TUBE DAMAGE.

(13) Check position of crossover tubes. See "Fits and Clearances", for illustration of tube clearance; JT8D-1,-1A,-1B,-7,-7A,-7B,-9,-9A chambers subsequent to PN 629XXX are measured while tubes are contacting at one side, but PN 629XXX and prior chambers use PWA 15707 Gage and uniform radial clearance.

NOTE: Clearance ring will crack or shatter if overly stressed, in which case procedure must be repeated. Rings shall be left in position, as they will burn away allowing clearance for expansion without physical contact.

(14) Torque crossover tube bolts and nuts to 35 - 40 pound-inches.

(15) For JT8D-9,-9A,-11, and -17 engines incorporating SB 4423, torque mount pin bolts to 65 - 85 pound-inches. For as manufactured straight-pin type installations, torque mount pin bolts to 150 - 170 pound-inches.

(16) Lockwire as follows (see Figure 406).

(a) Lockwire tube seal nut heads to crossover tube, then to bolt shank. See sheet 2 of figure.

(b) Lockwire mount pin bolts. For JT8D-9,-9A,-11, and -17 engines incorporating SB 4423, see sheet 4 of figure. For as manufactured straight-pin type installations see sheet 3 of figure.

(c) Install lockwire in holes provided in combustion chamber rear support assembly adjacent to bolt holes (18 places) and twist wire as required to reach bolt. Lockwire rear guide retaining bolt heads to rear support.

I. Repositioning Combustion Chamber Outer Case

CAUTION: BE CAREFUL NOT TO HIT THE COMBUSTION CHAMBERS WITH THE COMBUSTION CHAMBER OUTER CASE DURING CASE REMOVAL. INSPECTION SHOWS THAT INTERGRANULAR CRACKS IN THE CHAMBERS CAN GROW AND EXTEND SUDDENLY IF THE CHAMBERS ARE HIT.

(1) Using collar, carefully slide combustion chamber outer case forward, making certain it does not bump combustion chambers.

(2) Position turbine inner duct upper and lower front gangnut assemblies against rear flange of combustion
R chamber outer case. Apply Anti-seize Paste (PWA 36246)
R sparingly to bolt threads, remove unwanted paste, and install locknuts to secure. Install six jackscrew plugs in rear flange. Tighten locknuts and plugs and lockwire plugs.

(3) When installing used combustion chamber front flange
R nuts, apply Anti-seize Paste (PWA 36246) to nut threads
R and remove unwanted paste. New nuts are already coated.

NOTE: Do not use engine lubricating or oil of any kind on nuts.

CAUTION: THE BRACKETS WHICH ATTACH THE FUEL MANIFOLDS TO THE DIFFUSER CASE MUST HAVE A FLAT FIT AGAINST THE DIFFUSER CASE FLANGE. IF THERE IS A GAP BETWEEN THE BRACKETS AND THE FLANGE, MAKE SURE THAT THE FUEL MANIFOLD LOOP CLAMPS HAVE THE CORRECT SHIMS. IF FORCE IS USED TO HOLD THE BRACKETS IN POSITION DURING BOLT TORQUE, THIS WILL INCREASE STRESS ON THE FUEL MANIFOLDS. THIS STRESS CAN CAUSE FUEL MANIFOLD FRACTURE AND FUEL LEAKAGE.

(4) Install and torque nuts Chapter 72-00-00, Inspection/Check-02, Reference 922 (for JT8D-15,-15A,-17,-17A,-17R and -17AR, Reference 1008). Install jackscrew hole filler screws in

diffuser case rear flange. See Reference 712, (for JT8D-15,-15A,-17,-17A,-17R and -17AR, see Reference 116), for permissible gap under screw head. Torque and lockwire screws.

(a) When the combustion chamber outer case is installed, make an ultrasonic inspection of the rear flange of the combustion chamber outer case (refer to ASB6228 and NDIP-834). If a case is found to have cracks in the rear flange or in the case wall adjacent to the rear flange, the case is not serviceable and it will be necessary to remove the engine for case replacement.

NOTE: This inspection is applicable only to combustion chamber outer case PN 490547, 542155, 616315, 728829, 728829-001, 730413, 730413-001, 730414, 730414-001, 767197, 767279, and 767279-001.

(5) Install fan discharge turbine section inner duct halves.

(a) Install two inner duct halves around turbine nozzle section. Secure them together and to turbine section front gang nut assemblies with screws at rear flange of combustion chamber outer case.

(b) For JT8D-1,-1A,-1B,-7,-7A,-7B,-9,-9A,-11,-17,-17A engines with double noise attenuation equipment and engines incorporating SB 3781, install fan discharge turbine exhaust inner front duct and band segments which secure rear of fan discharge turbine inner duct to gang nut assembly at rear flange of turbine nozzle rear case.

NOTE: On engine incorporating PN 753814 shield segments, secure front edge of front duct with bolts and washers threaded through front duct and turbine case bracket into turbine case shield locknuts (remove duct bolts or workbolts previously installed to retain case shield but do not allow shield to drop away from bracket.)

R
R

CAUTION: END OF FAN DUCT STRAP IN FOLLOWING STEP MUST BE LOCKED SO IT IS ENCLOSED BY NO. 4 BEARING TUBES FAIRING AND, WHEN INSTALLED, BY LEFT IGNITER PLUG FAIRING.

(6) Position diffuser fan duct strap (if assembly requires one) around diffuser case rear flange. Position end in front of left igniter plug boss.

(7) Install screws and tighten.

(8) Install left igniter cable fairing on rear of No. 4 bearing tubes fairing (eight o'clock position). Secure with the four washers and bolts. Tighten bolts to recommended torque.

(9) Make certain rings are in place then install left and right diffuser air supply manifolds. Secure in place with locknuts. Tighten locknuts to recommended torque.

(10) Using new gaskets, reinstall exterior engine and airframe manifolds and/or covers on high pressure bleed pads on diffuser section outer duct.

J. Installing Combustion Section Fan Duct

(1) Install combustion chamber fuel drain manifold (or drain tube connectors if so required) and fuel drain valves.

CAUTION: INSPECT FUEL DRAIN VALVE FOR CORRECT GAP SETTING. SEE INSTALLATION-FUEL DRAIN MANIFOLD IN FAN DISCHARGE SECTION-MAINTENANCE PRACTICES AND FITS AND CLEARANCES, AND SECTION 72-00, REMOVAL/INSTALLATION, REFERENCE 89.

(2) Place combustion section upper duct in position on top of engine, being careful to avoid damaging inner burner pressure tube (if so equipped). Match hole on flanges with positioning pins at 9 o'clock position on mating cases then install enough bolts, washers, and locknuts on Flanges J and K, boltheads to rear, to hold segment in place.

(3) Position combustion section lower duct under engine and raise it, engaging two connectors (if so equipped), into position around bottom half of engine.

R
R

(4) Install remaining bolts, washers, locknuts, and brackets as noted in disassembly and nuts along each side of duct, boltheads up. Tighten nuts to recommended torque.

(5) Install remaining bolts, washers, locknuts, and brackets around Flanges J and K, boltheads positioned as previously specified and brackets as noted at disassembly. Tighten nuts to recommended torque.

(6) Install new packing, lubricated with a thin layer of PWA 36500 Assembly Fluid or petrolatum in groove at outer end of fuel drain manifold (or in groove of each fuel drain tube connector).

(7) Install new packing lubricated with a thin layer of PWA 36500 Assembly Fluid or petrolatum, in rear connector packing holder and install the holder up over rear fuel drain tube against lower duct boss. Install four bolts, washers, sleeve spacer, (flanged ends outward) and locknuts. Tighten locknuts to recommended torque.

NOTE: If combustion chamber and turbine fan duct incorporating two fuel drain bosses is used with fuel drain manifold, front boss must be closed off with PN 556332 Cover and associated packing, bolts (4), washers (8), and locknuts (4).

NOTE: If exciter and attaching brackets were removed from lower fan duct, reinstall parts onto flanges and torque retaining screws to Fits and Clearances Reference 1031, (Section 72-00, Removal/Installation).

(8) Install and secure packing holder and related parts on front fuel drain tube connector in same manner as given in previous step.

NOTE: No bracket is required at front connector.

(9) If engine has burner pressure boss on combustion section fan duct, install new preformed packing, lubricated with PWA 36500 Assembly Fluid, on end of inner burner pressure tube. Install packing in burner pressure tube packing holder and install packing holder over tube. Insert sleeve spacer in each bolthole and bolt packing holder in place. Torque bolts.

CAUTION: REFER TO SECTION 74-22-01, IGNITER PLUGS - REMOVAL/INSTALLATION FOR INSTALLATION OF CORRECT TYPE IGNITER PLUG.

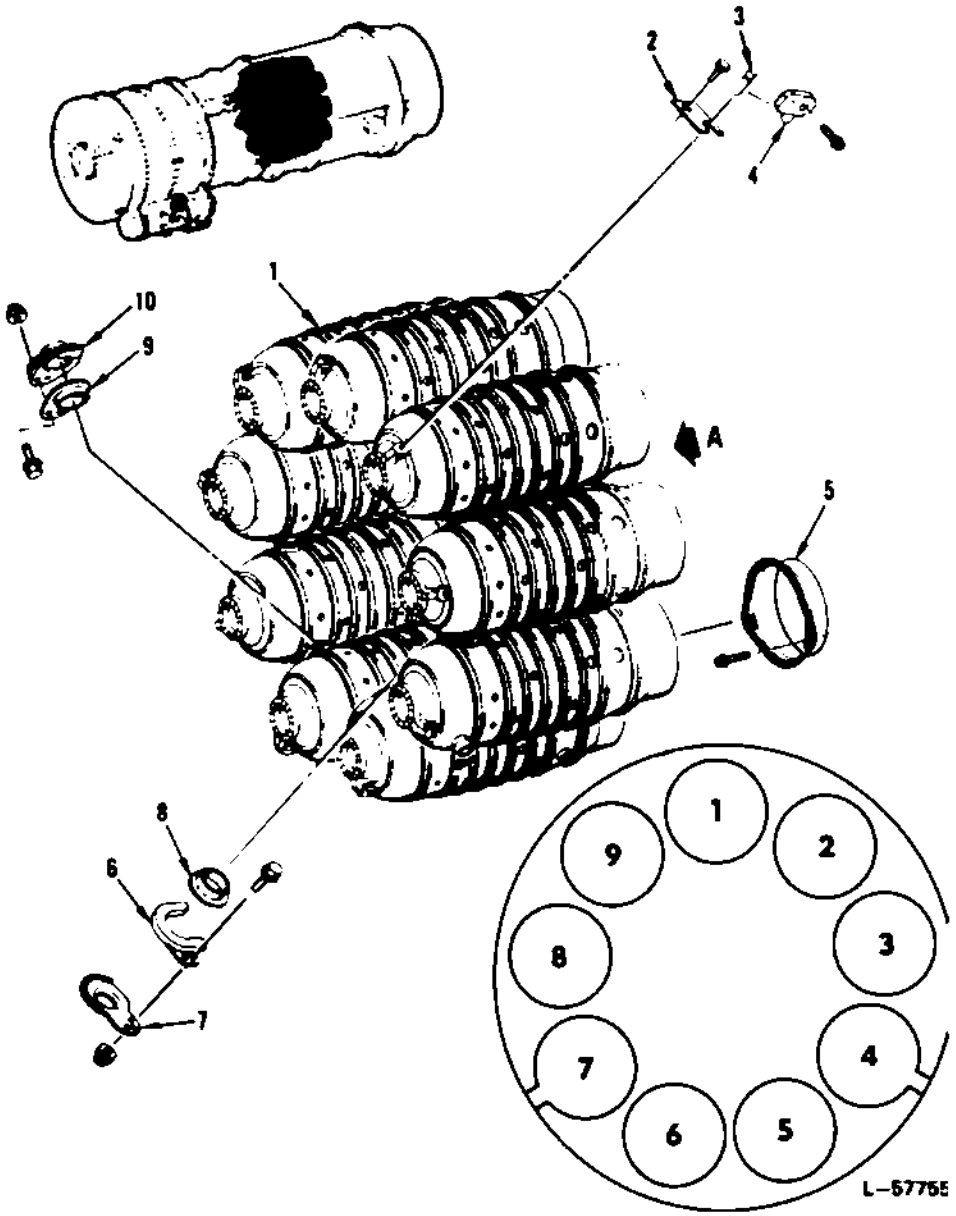
(10) Install igniter plugs and connect igniter plug leads.

(11) Position packing and retainer at each end and install No. 6 bearing external oil pressure tube along left side of engine. Tighten tube coupling nuts to recommended torque and lockwire.

(12) Position clips and spacers for oil tube as noted at disassembly. Reposition thermocouple cable along oil tube and secure it to clips, brackets, and spacers with screws. Secure cable outlet connectors at flanges J and K as noted at disassembly. Secure with screws, washers and nuts. Tighten all attaching screws to recommended torque.

K. Numerical Tool List

PWA 12044	Collar - Combustion Chamber Outer Case
PWA 15707	Gage - (Quantity as Required)
PWA 33536	Puller - Combustion Chamber Positioning Pin
PWA 45226	Fixture - Vane Retaining

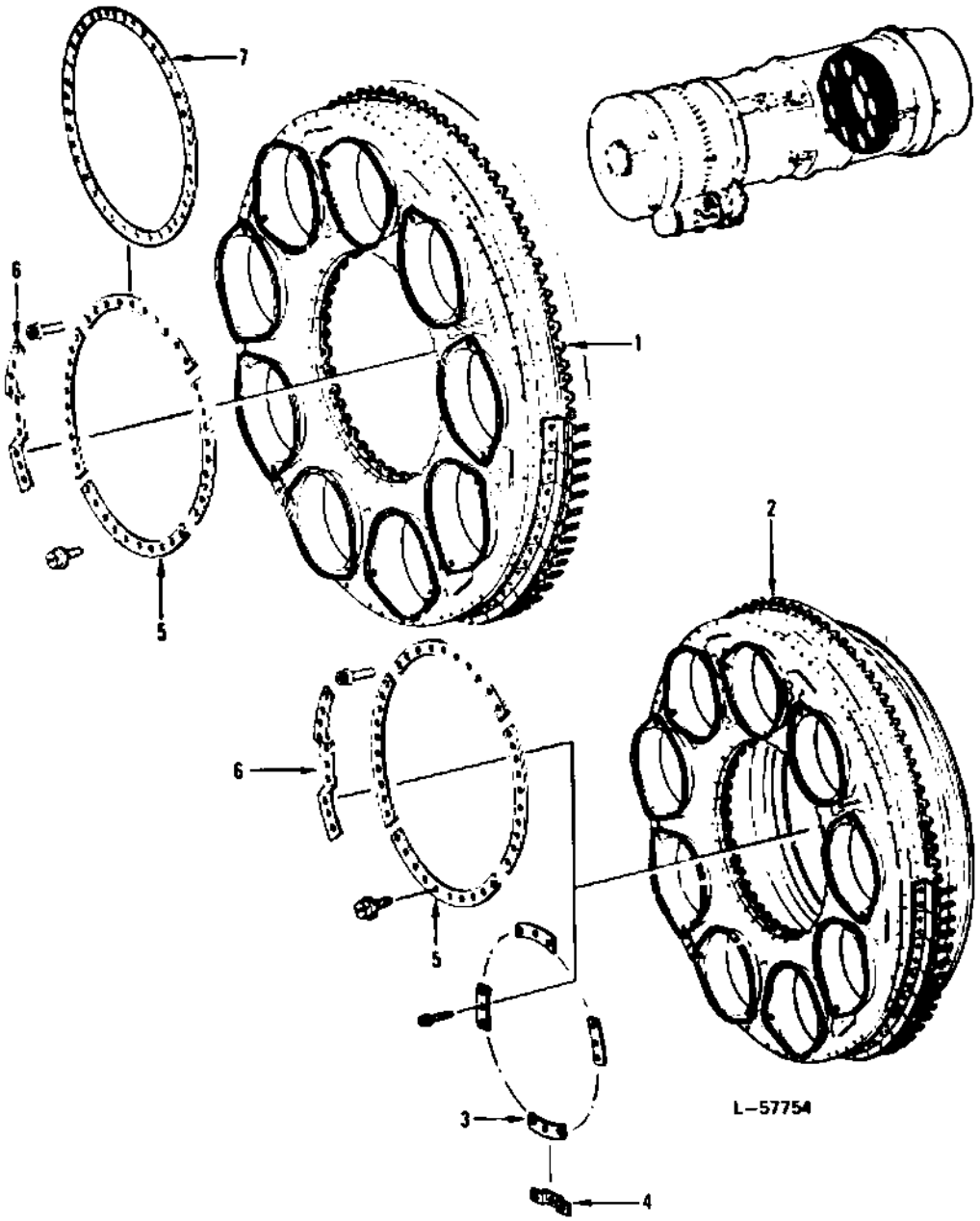


SCHEMATIC VIEW IN DIRECTION A

Combustion Chamber
Removal/Installation
Figure 401
(Task 72-40-00-420-001)

1. Combustion Chamber (Nine Required, Numbered As Shown)
2. Combustion Chamber Lock (Slanted-Pin Chambers)
3. Combustion Chamber Pin (Slanted-Pin Chambers)
4. Combustion Chamber Pin (Straight-Pin Chambers)
5. Combustion Chamber Guide (One Per Chamber)
6. Combustion Chamber Clamp Assembly (Use With Index 8 Tube)
7. Crossover Tube Flange Detail Of Combustion Chamber (Reference)
8. Interconnector Tube (Floating Type)
9. Interconnector Tube (Bolted Type)
10. Crossover Tube Flange Detail Of Combustion Chamber (Reference)

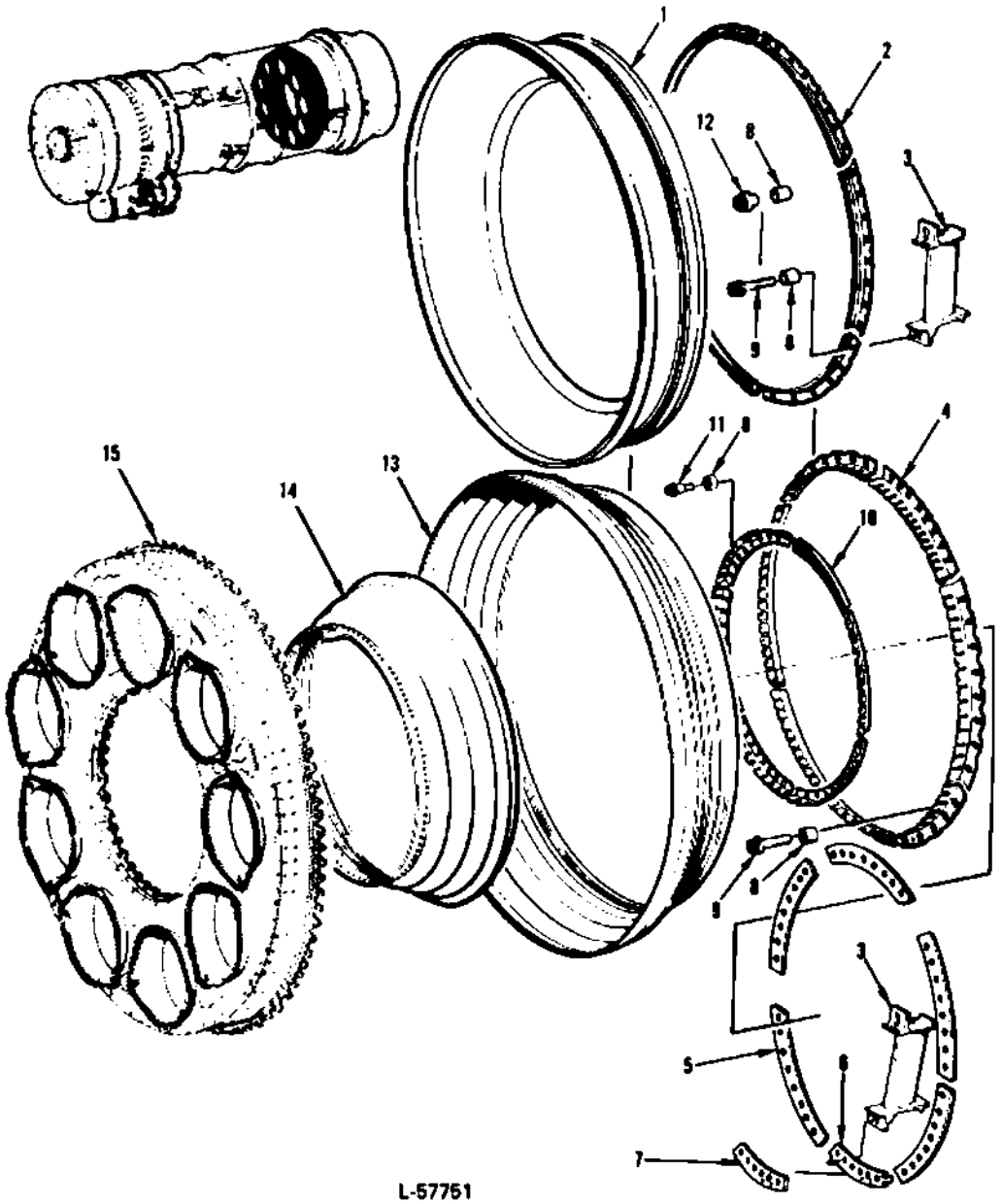
Key to Figure 401



Combustion Chamber Duct Assembly/
Rear Support Removal/Installation
Figure 402
(Task 72-40-00-420-001)

1. Combustion Chamber Rear Support Assembly
2. Combustion Chamber Duct Assembly
3. PN 762760 Turbine Stator Support Screw Positioning Plate, 3 Required (For Use With PN 746059 or 702694 Combustion Chamber Duct Assembly)
4. PN 762761 Turbine Stator Support Screw Positioning Plate (For Use With PN 746059 or 702694 Combustion Chamber Duct Assembly)
5. PN 674160 Combustion Chamber Support Reinforcing Plate (3 Required For Use With PN 614334 Combustion Chamber Duct Assembly Or Prior Index 1 Combustion Chamber Rear Support Assemblies, 4 Required For Use With Index 2 Combustion Chamber Duct Assembly).
6. PN 674159 Combustion Chamber Support Reinforcing Plate (For Use With PN 614334 Combustion Chamber Duct Assembly Or Prior Index 1 Combustion Chamber Rear Support Assemblies)
7. PN 594068 Or Prior Reinforcing Plate

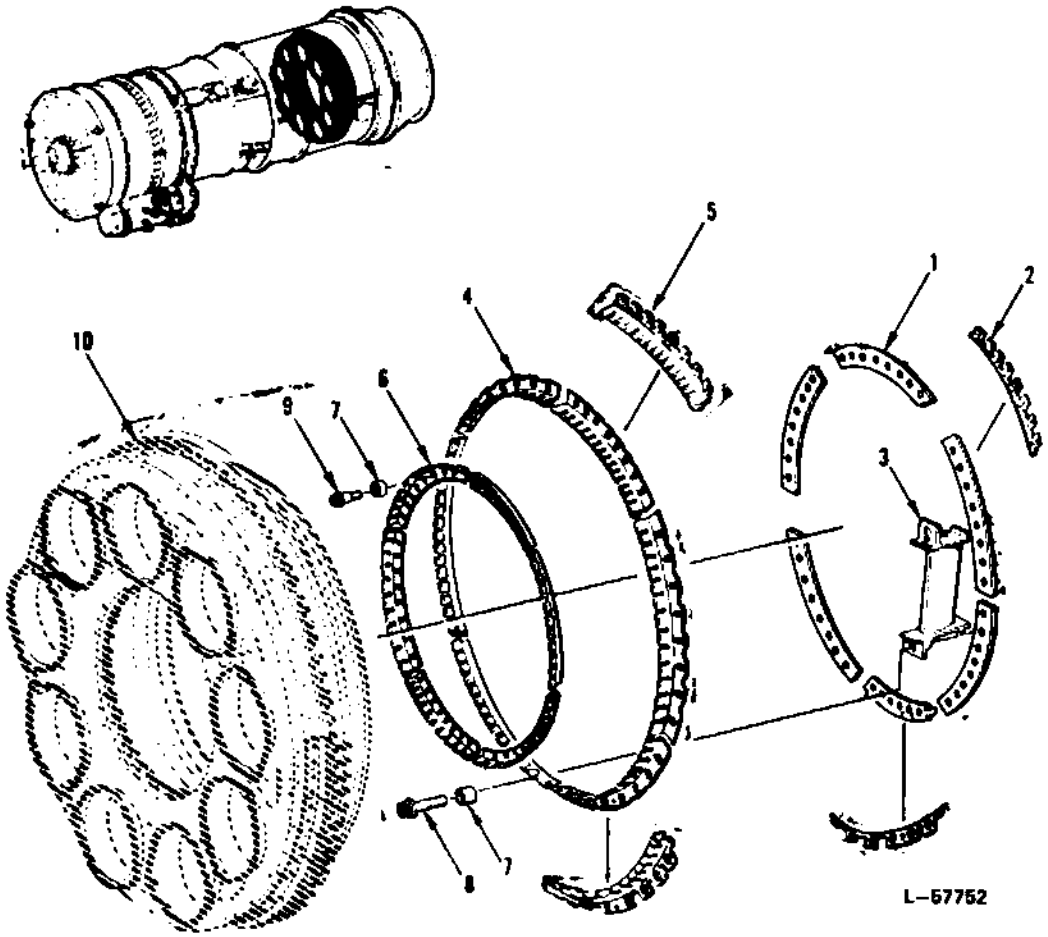
Key to Figure 402



Combustion Chamber Outlet
Area (Separable Duct Type)
Figure 403 (Sheet 1)
(Task 72-40-00-420-001)

1. Combustion Chamber Outer Outlet Duct (Non-Louvered)
2. Combustion Chamber Outer Duct Rear Support (Used With Index 1 Outer Duct)
3. First Stage Turbine Vane
4. Combustion Chamber Duct Outer Rear Support Segments (Used With Index 13 Outer Duct)
5. Combustion Chamber Duct Support Plate Spacers (5 Required), Used With Index 13 and 14 Ducts.
6. Combustion Chamber Duct Support Plate Spacer With Positioning Lugs, Must Be Mated With Index 4 Rear Support Incorporating SB 3297.
7. Combustion Chamber Duct Support Plate Spacer Without Positioning Lugs (See Text).
8. Sleeve Spacer
9. Bolt - 1st Stage Turbine Vane Outer Foot
10. Combustion Chamber Duct Inner Rear Support Segments
11. Bolt - 1st Stage Turbine Vane Inner Foot
12. Nut - 1st Stage Turbine Vane Outer Foot (Used On Turbine Assembly Incorporating SB 1194)
13. Combustion Chamber Outer Outlet Duct (Louvered)
14. Combustion Chamber Inner Outlet Duct
15. Combustion Chamber Rear Support (Reference)

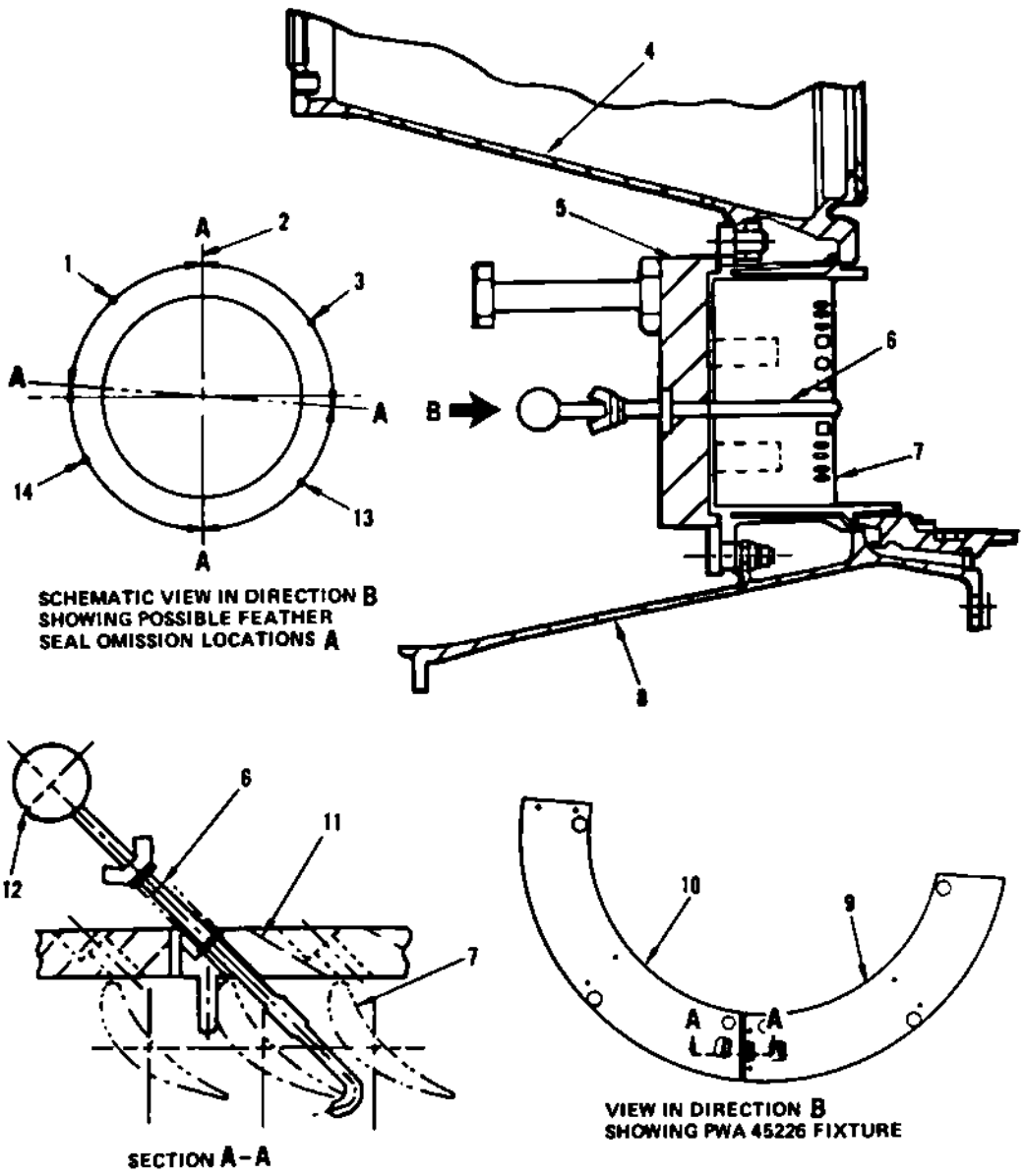
Key to Figure 403 (Sheet 1)



Combustion Chamber Outlet
Area (Integral Duct Type)
Figure 403 (Sheet 2)
(Task 72-40-00-420-001)

1. Combustion Chamber Duct Support Plate Spacer
2. Combustion Chamber Duct Support Plate Spacer (Use With PN 737271 1st Stage Turbine Vane)
3. First Stage Turbine Vane
4. Combustion Chamber Duct Outer Rear Support Segments
5. Combustion Chamber Duct Outer Rear Support Segments (Use With Index 2 Segments)
6. Combustion Chamber Duct Inner Rear Support Segments
7. Sleeve Spacer
8. Bolt - 1st Stage Turbine Vane Outer Foot
9. Bolt - 1st Stage Turbine Vane Inner Foot
10. Combustion Chamber Duct Assembly (Reference)

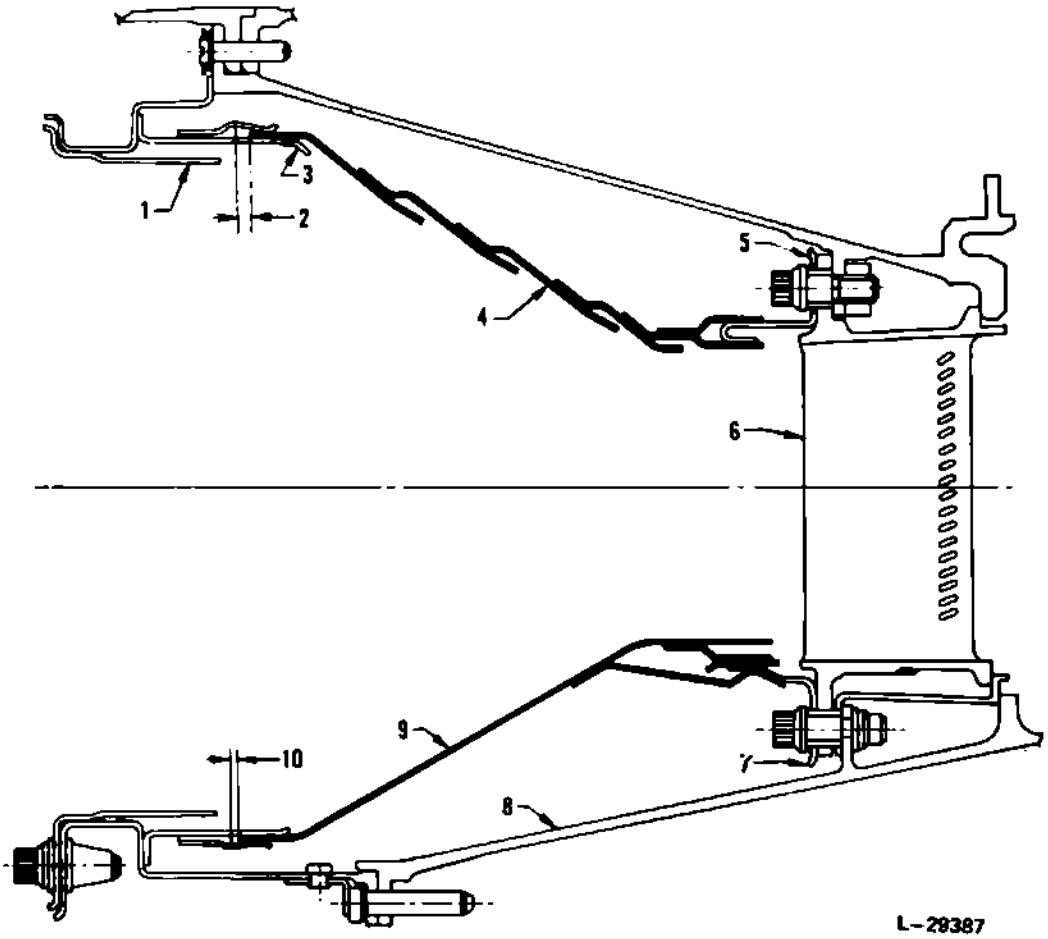
Key to Figure 403 (Sheet 2)



First Stage Turbine Vane
Installation (SB 5021, SB 5455
and -15A,-17A and -17AR Type)
Figure 404
(Task 72-40-00-420-001)

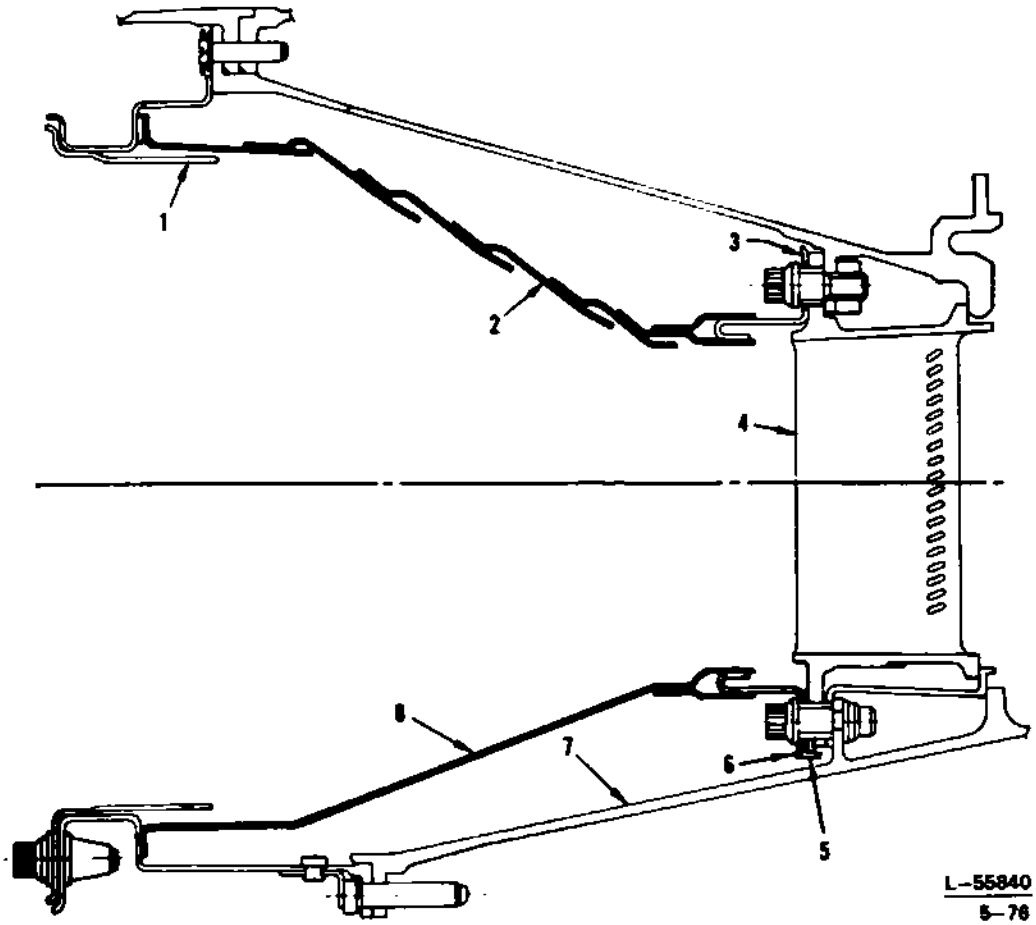
1. Segment Of 11 Vanes
2. Vertical Centerline
3. Segment Of 12 Vanes
4. Turbine Stator Support Assembly
5. PWA 45226 Fixture
6. Aluminum Hook
7. First Stage Turbine Vane
8. Turbine Front Case Assembly
9. Fixture Segment Of 11 Vanes
10. Fixture Segment Of 12 Vanes
11. Fixture Segment
12. Dot (Aligned With Hook)
13. Segment Of 11 Vanes
14. Segment Of 12 Vanes

Key to Figure 404



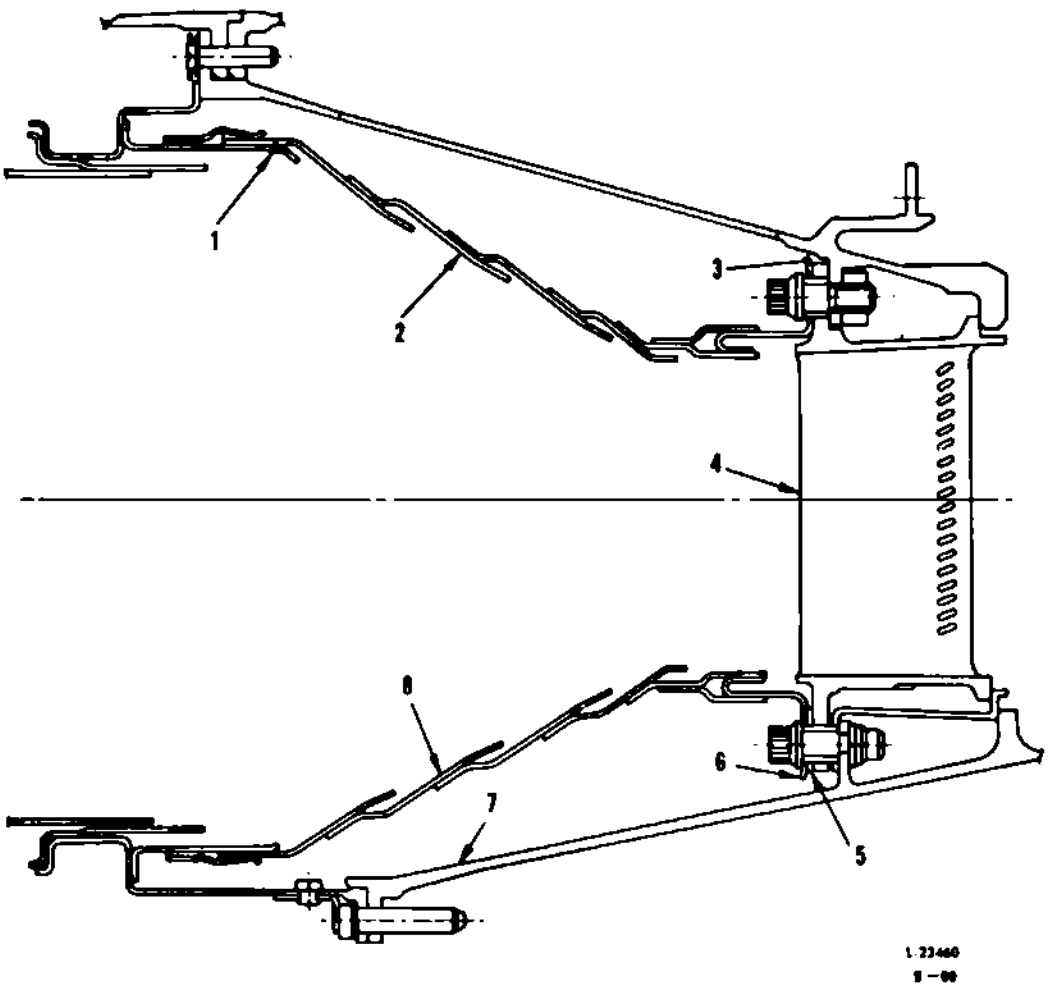
1. Guide
2. 0.140 Inch Minimum
3. Combustion Chamber Rear Support
4. Combustion Chamber Inner Outlet Duct
5. Combustion Chamber Duct Inner Rear Support
6. Turbine Nozzle Vane
7. Combustion Chamber Duct Outer Rear Support
8. Turbine Front Case
9. Combustion Chamber Outer Outlet Duct
10. 0.120 Inch Minimum

Combustion Chamber Outlet
Duct Positions (Non-Louvered
Outer Duct, Separable Type)
Figure 405 (Sheet 1)
(Task 72-40-00-420-001)



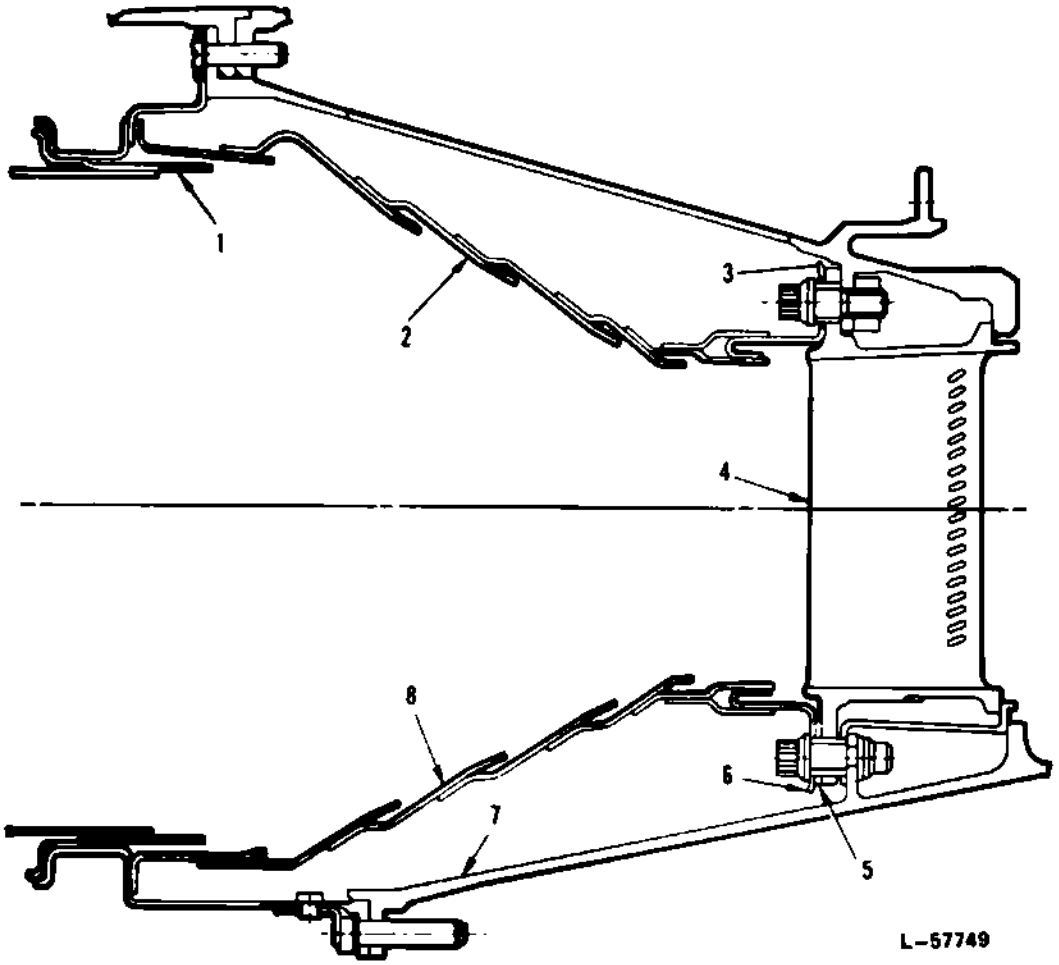
1. Combustion Chamber Guide
2. Combustion Chamber Outlet Inner Duct
3. Combustion Chamber Outlet Duct Inner Rear Support
4. Turbine Nozzle Vane
5. Plate Spacer
6. Combustion Chamber Outlet Duct Outer Rear Support
7. Turbine Front Case
8. Combustion Chamber Outlet Outer Duct

Combustion Chamber Outlet
Duct Position (Integral Type,
Non-Louvered Outer Duct)
Figure 405 (Sheet 2)
(Task 72-40-00-420-001)



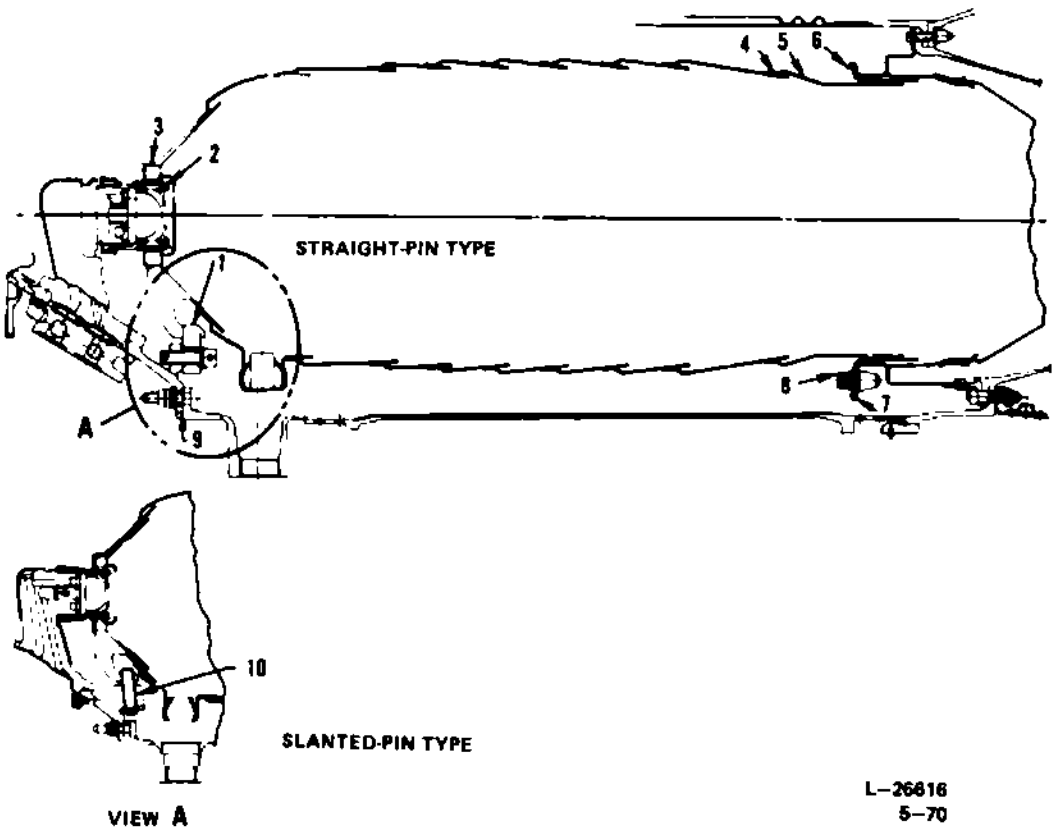
1. Combustion Chamber Rear Support
2. Combustion Chamber Inner Outlet Duct
3. Combustion Chamber Outlet Duct Inner Rear Support
4. First Stage Turbine Vane
5. Spacer-Plate
6. Combustion Chamber Outlet Duct Outer Rear Support
7. Turbine Outer Front Case
8. Combustion Chamber Outer Outlet Duct

Louvered Combustion Chamber Outlet
Duct Positions (Separable Type)
Figure 405 (Sheet 3)
(Task 72-40-00-420-001)



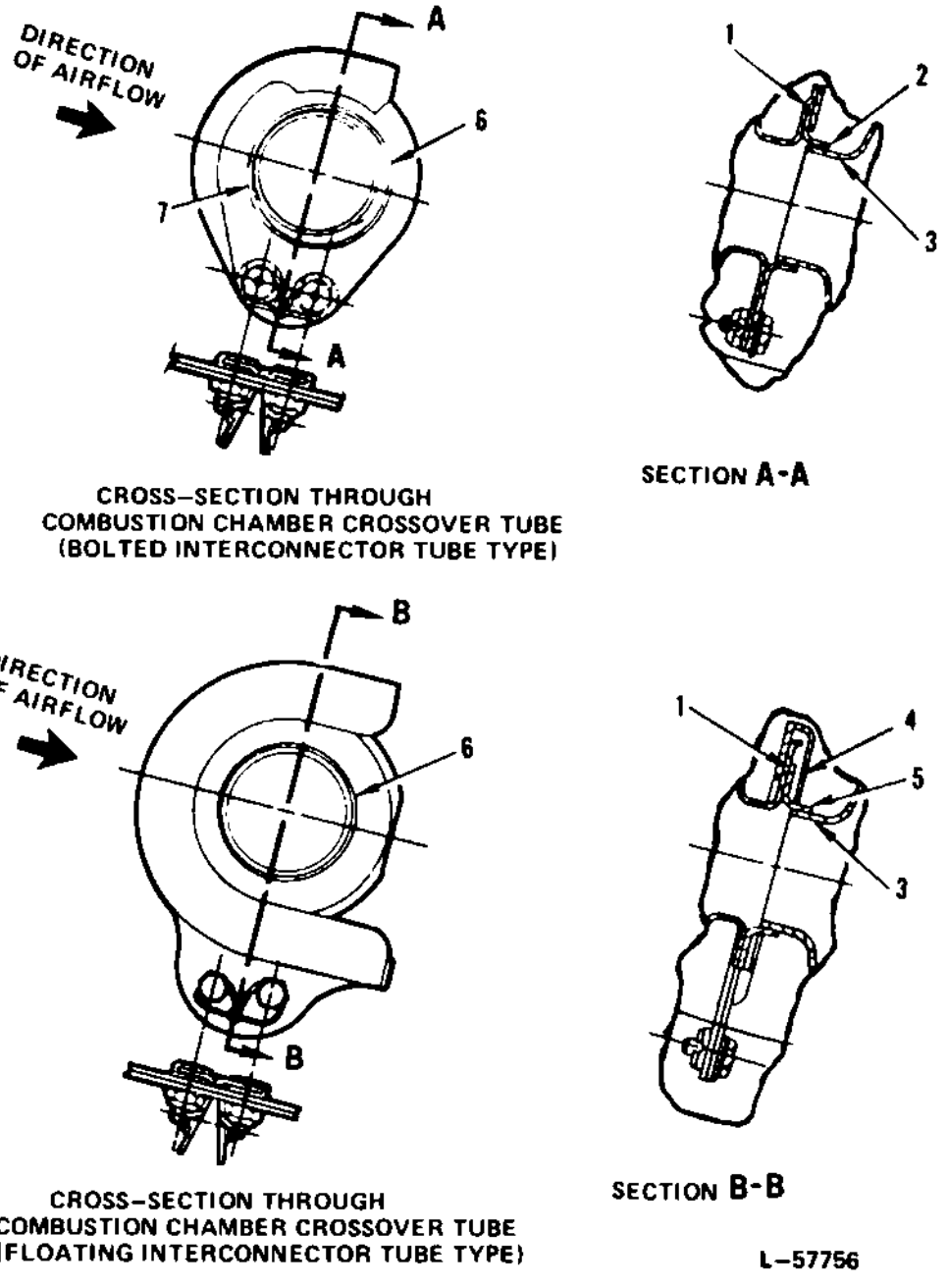
1. Combustion Chamber Guide
2. Combustion Chamber Outlet Inner Duct
3. Combustion Chamber Duct Inner Rear Support Segment
4. First Stage Turbine Vane
5. Spacer - Plate
6. Combustion Chamber Duct Outer Rear Support Segment
7. Turbine Outer Front Case
8. Combustion Chamber Outlet Outer Duct

Combustion Chamber Outlet
Duct Position (Integral Type)
Figure 405 (Sheet 4)
(Task 72-40-00-420-001)



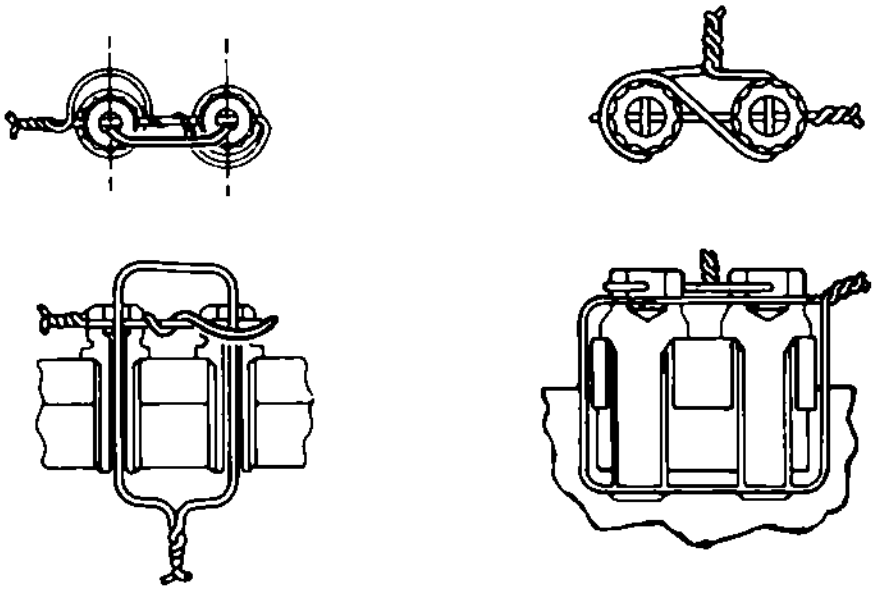
1. Mounting Pin
2. Fuel Nozzle Heatshield
3. Fuel Nozzle Stator
4. Combustion Chamber Detail Rear Liner
5. Diverging Portion Of Rear Liner
6. Combustion Chamber Rear Positioning Guide
7. Combustion Chamber Rear Support
8. Combustion Chamber Support Bolt (2 Required At Each Location)
9. Diffuser Case Rear Flange
10. Mounting Pin

Combustion Chamber Installation
Figure 406 (Sheet 1)
(Task 72-40-00-420-001)



1. Combustion Chamber Female Crossover Tube Flange
2. Interconnector Tube (Bolted Type)
3. Combustion Chamber Male Crossover Tube
4. Clamp
5. Interconnector Tube (Floating Type)
6. See Fits and Clearances For Clearance Limits
7. Assemble Interconnector Tube With Zero Clearance At This Point (Leading Edge) (Applicable Assemblies Only - See Text)

Combustion Chamber Installation
Figure 406 (Sheet 2)
(Task 72-40-00-420-001)



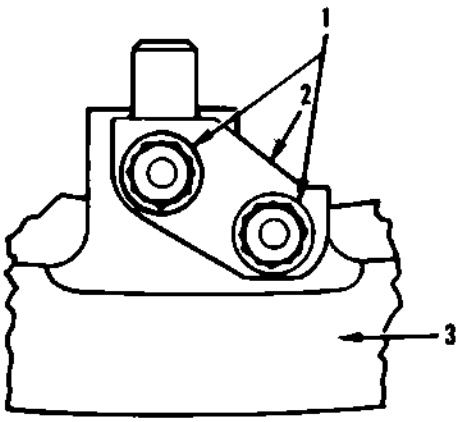
HOLLOW PIN BOLTS

SOLID PIN BOLTS

**CROSS-SECTION THROUGH
COMBUSTION CHAMBER RETAINING PIN BOLTS
(STRAIGHT-PIN TYPE)**

**L-57757
3-81**

Combustion Chamber Installation
Figure 406 (Sheet 3)
(Task 72-40-00-420-001)



L-49510
6-75

1. Combustion Chamber Mount Pin Bolts. Lockwire These Bolts Together.
2. Combustion Chamber Mount Pin
3. Diffuser Case Flange

Combustion Chamber Installation
(Engines Incorporating SB 4423)
Figure 406 (Sheet 4)
(Task 72-40-00-420-001)

Task 72-40-00-220-001:

1. Combustion Area (Hot Section) Inspection

NOTE: Combustion area (Hot Section) inspection is included in this manual since it can be physically accomplished on the wing. However, experience indicates it is more convenient to remove the engine and perform these tasks at a heavy maintenance level per the JT8D ENGINE MANUAL, Chapter/Section 72-00-00, Check-01.

A. Basic Hot Section Inspection Requirements

(1) Remove and inspect combustion chambers. Inspect per Section 72-41-14, Maintenance Practices.

(2) Inspect combustion chamber inner and outer ducts per Section 72-51-21, Maintenance Practices.

(3) Inspect 1st stage turbine vanes per Section 72-50-00, Maintenance Practices.

(4) Inspect 1st stage turbine blades per Section 72-50-00, Maintenance Practices.

(5) Visually inspect 4th stage turbine blades for nicks, dents, and cracks.

(6) Visually inspect (looking forward through diffuser case) 13th stage compressor blades and exit stator vanes for evidence of nicks, dents, and cracks.

(7) Inspect fuel nozzles and supports per Chapter/Section 73-00-00, Maintenance Practices.

NOTE: On fuel system with conical-seat fuel nozzle connections but without transfer tubes (incorporating SB 2722 but prior to SB 4484), retorque fuel nozzle connections per Chapter/Section 73-00-00, Inspection/Check every time connections are accessible.

(8) For all engines incorporating EGT System Boost Circuit, perform electrical check per Section 77-20-00,

Task 72-40-00-990-002:

1. Combustion Fits And Clearances; JT8D

See Figure 601 thru Figure 605.

NOTE: For a description of terms, symbols and torque references used in the following paragraph, see paragraph titled Fits and Clearances, Engine Removal/Installation, Section 72-00-00.

A. Combustion Section - Fits and Clearances:
JT8D-1,-1A,-1B,-7,-7B,-9,-9A

REF. NO.	DESCRIPTION	REF. DIM. MIN	REF. DIM. MAX	LIMITS MIN	LIMITS MAX	REPLACE IF OVER
581	Smoke Reduced Combustion Chamber With Hardfacing Male Crossover Tube	1.279	1.283			
	Interconnector Tube	1.295	1.301	.012	.022	
	Smoke Reduced Combustion Chamber Without Hardfacing Male Crossover Tube	1.273	1.277			
	Interconnector Tube	1.289	1.295	.012	.022	
	Non-Smoke Reduced Combustion Chamber With Hardfacing Male Crossover Tube	1.004	1.012			
	Interconnector Tube	1.053	1.065	.041	.061	
	Non-Smoke Reduced Combustion					

REF. NO.	DESCRIPTION	REF. DIM. MIN	REF. DIM. MAX	LIMITS MIN	LIMITS MAX	REPLACE IF OVER
(CONTINUED)						
	Chamber Without Hardfacing Male Crossover Tube	1.000	1.004			
	Interconnector Tube	1.061	1.069	2 .057	.069	
623	Diffuser Case (Rear Flange)	31.343	31.349			
	Combustion Chamber Outer Case (Front Flange)	31.337	31.343	.000	.021T	.002
624	Turbine Nozzle Case (Front Flange Rear)	29.842	29.846			
	Combustion Chamber Outer Case (Rear Flange)	29.838	29.842	.000	.008T	.002
625	Turbine Nozzle Case (Front Flange Front)	29.663	29.667			
	Combustion Chamber Support Assembly	29.669	29.675	.002	.012	.014
706	Chevron Seal at Free Height	.108	.111			
707	Chevron Seal Pinch			.007T	.012T	
708	Diffuser Case Mount Pad	.247	.249			
709	Fuel Nozzle Support "Snout"	.152	.156			

REF. NO.	DESCRIPTION	REF. DIM. MIN	REF. DIM. MAX	LIMITS MIN	LIMITS MAX	REPLACE IF OVER
710	Spacer Plate Thickness or Manifold Groove Depth	.099	.101			
711	Fuel Nozzle Support "Snout"	.251	.255			
712	Jack Screw Hole Filler Screw Head Gap			.000	.030	
745	Fuel Nozzle Nut, Assembly of (PN 490611 and A, 491437)	1.528	1.532			
	Combustion Chamber, Assembly of	1.539	1.541	.007	.013	.025
	Fuel Nozzle Nut, Assembly of (PN 490611B, 491437A, 520057)	1.527	1.529			
	Combustion Chamber, Assembly of	1.539	1.541	.010	.014	.028
	Fuel Nozzle Nut, Assembly of (PN 490611C, 491437B, 520057A, and Alphabetically Subsequent)	1.525	1.529			
	Combustion Chamber, Assembly of	1.539	1.541	.010	.016	.028
	Fuel Nozzle Nut PN 674339 Or Later Reduced Smoke	1.524	1.526			

REF. NO.	DESCRIPTION	REF. DIM. MIN	REF. DIM. MAX	LIMITS MIN	LIMITS MAX	REPLACE IF OVER
(CONTINUED)						
	Combustion Chamber	1.534	1.540	.008	.016	.028
746	Combustion Chamber Pin	.3725	.3735			
	Combustion Chamber - Assembly of	.3745	.3755	.001	.003	.005
	Combustion Chambers Having Cobalt Alloy Pin Hole Sleeve Bushings (Ref. PN 731561)	.3755	.3765	.002	.004	.006
	Combustion Chambers Having Hardfaced Pin Hole Sleeve Bushings (Ref. PN 748285)	.3755	.3775	.002	.005	
747	Slanted-Pin Type Assy: Combustion Chamber Pin	.3725	.3735			
	Diffuser Case	.3745	.3765	.001	.004	.005
748	Combustion Chamber - Assembly of	6.230	6.236			
	Guide - Combustion Chamber - Assembly of	6.240	6.244	.004	.014	.014

REF. NO.	DESCRIPTION	REF. DIM. MIN	REF. DIM. MAX	LIMITS MIN	LIMITS MAX	REPLACE IF OVER
752	Combustion Chamber Inner Case (Incorporating SB 1747)	13.508	13.510			
	Combustion Chamber Rear Support PN 572674L, 636993E, 664405A And Later Parts	13.510	13.518	.000	.010	
	Combustion Chamber Rear Support (Incorporating SB 1747 But Prior To Above)	13.500	13.508	.000	.010T	.002
	Combustion Chamber Inner Case (Prior To SB 1747)	13.497	13.499			
	Combustion Chamber Rear Support (Prior To SB 1747)	13.489	13.497	.000	.010T	.002
755	Rear Combustion Chamber Support Guide - Combustion Chamber Assembly of	6.405	6.415			
		6.395	6.405	.000	.020	
832	See Table 401.					

REF. NO.	DESCRIPTION	REF. DIM. MIN	REF. DIM. MAX	LIMITS MIN	LIMITS MAX	REPLACE IF OVER
845	Engines Incorporating SB 5021: Vanes may be shifted circumferentially to meet mismatch limits. Three-class spread of adjacent vanes must not be exceeded.			0.000	0.040	

REF. NO.	DESCRIPTION	LIMITS MIN	LIMITS MAX	REPLACE IF OVER
904	1st Stage Turbine Vane Inner Mounting Bolt - (Do not use lubricating oil on this bolt during while assembly applying torque.)	45	50	
906	For Turbine Assembly Using "Short" Front Turbine Cases, With PN 431095 Plate Nuts In Rear Turbine Case ("Long" Type): 1st Stage Turbine Vane Outer Mounting Bolt	75	85	
	For Turbine Assembly Using "Short" Front Turbine Case, With PN 528766 Plate Nuts In Rear (Or Intermediate) Turbine Case: 1st Stage Turbine Vane Outer Mounting Bolt	55	60	
	For Turbine Assembly Using PN 539480 Studs (Threaded Into Intermediate Turbine Case): 1st Stage Turbine Vane Outer Mounting Stud Nut (Install Stud To Bottom In Dome Nut And Torque Nut To Value Given. If Lockwire Hole Does Not Line Up, Loosen Nut And Back Off Stud 90 Degrees Maximum. Re-torque Nut. Lockwire Minimum Of Two Studs			

REF. NO.	DESCRIPTION	LIMITS MIN	LIMITS MAX	REPLACE IF OVER
(CONTINUED)				
	Together).	65	75	
	For Turbine Assembly Using PN 554947 Bolts: 1st Stage Turbine Vane Outer Mounting Bolt	55	60	
	NOTE: Do not use lubricating oil on any of above bolts, nuts or studs while applying torque.			
922	Diffuser Case Rear Flange Combustion Chamber Outer Case (Retaining Bolts) Do not use lubricating oil on these bolts during assembly torquing.	67	75	
989	Fuel Manifolds Installation Instructions			
	(1) Place Fuel manifold on corresponding diffuser case pads and determine which connectors will first be in contact with pads.			
	(2) Install bolts at these locations with a torque of 5 lb-in.			
	(3) Any other pads that can now be seated with a maximum load of 5 lb. shall have bolts installed with a torque of 5 lb - in.			
	(4) Determine acceptable mismatch of remaining connectors and pads as follows:			
	(a) Maximum allowable gap between gap pad and connector 0.040 inch.			
	(b) Pad and connector must be parallel within 0.015 inch.			
	(c) Maximum bolt hole misalignment			

REF. NO.	DESCRIPTION	LIMITS MIN	LIMITS MAX	REPLACE IF OVER

(CONTINUED)

0.050 inch.

(5) After completion of above steps, torque all bolts.

B. Combustion Section - Fits and Clearances JT8D-11 Figure 603 And Figure 604.

NOTE: For a description of terms, symbols, and torque references used in the following paragraph, see paragraph entitled Fits and Clearances, ENGINE - REMOVAL/INSTALLATION, Section 72-00.

REF. NO.	DESCRIPTION	REF. DIM. MIN	REF. DIM. MAX	LIMITS MIN	LIMITS MAX	REPLACE IF OVER
581	Combustion Chambers With Floating Interconnectors With Hardfacing Male Crossover Tube	1.279	1.283			
	Interconnector Tube	1.289	1.295	.006	.016	
	Combustion Chambers Without Hardfacing With Floating Interconnectors Male Crossover Tube	1.273	1.277			
	Combustion Chamber Interconnector Tube	1.283	1.289	.006	.016	.030
	Combustion Chambers With Bolted Interconnectors					

REF. NO.	DESCRIPTION	REF. DIM. MIN	REF. DIM. MAX	LIMITS MIN	LIMITS MAX	REPLACE IF OVER
	(CONTINUED)					
	With Hardfacing					
	Male					
	Crossover Tube	1.279	1.283			
	Interconnector					
	Tube	1.295	1.301	.012	.022	
	Combustion					
	Chambers					
	With Bolted					
	Interconnectors					
	Without					
	Hardfacing:					
	Male					
	Crossover Tube	1.273	1.277			
	Interconnector					
	Tube	1.289	1.295	.012	.022	
623	Diffuser Case					
	(Rear Flange)	31.343	31.349			
	Combustion					
	Chamber Outer					
	Case					
	(Front Flange)	31.337	31.343	.000	.012T	.002
624	Turbine Nozzle					
	Case (Front					
	Flange Rear)	29.842	29.846			
	Combustion					
	Chamber Outer					
	Case					
	(Rear Flange)	29.838	29.842	.000	.008T	.002
625	Turbine Nozzle					
	Case (Front					
	Flange Front)	29.663	29.667			
	Combustion					
	Chamber					
	Support Assembly	29.669	29.675	.002	.012	.014
712	Jackscrew Hole					
	Filler Screw					
	Head Gap			.000	.030	

REF. NO.	DESCRIPTION	REF. DIM. MIN	REF. DIM. MAX	LIMITS MIN	LIMITS MAX	REPLACE IF OVER
745	Fuel Nozzle Nut, Assembly of	1.525	1.529			
	Combustion Chamber, Assembly of	1.539	1.541	.010	.016	.028
746	Combustion Chamber Pin	.3725	.3735			
	Combustion Chamber - Assembly of	.3745	.3755	.001	.003	.005
	Combustion Chambers Having Cobalt Alloy Pin Hole Sleeve Bushings (Ref PN 733205)	.3755	.3775	.002	.004	.006
	Combustion Chambers Having Hardfaced Pin Hole Sleeve Bushing (Ref PN 748287)	.3755	.3775	.002	.005	
747	Chamber Pin Slanted-Pin Type	.3725	.3735			
	Combustion Diffuser Case - Assembly of	.3745	.3765	.001	.004	.004
748	Combustion Chamber - Assembly of	6.230	6.236			
	Guide - Combustion Chamber - Assembly Of	6.240	6.244	.004	.014	.014

REF. NO.	DESCRIPTION	REF. DIM. MIN	REF. DIM. MAX	LIMITS MIN	LIMITS MAX	REPLACE IF OVER
755	Rear Combustion Chamber Support Guide - Combustion Chamber Assembly of	6.405	6.415			
		6.395	6.405	.000	.020	
832	See Table 402.					
845	Engines Incorporating SB 5455: Vanes may be shifted circumferentially to meet mismatch limits. Three-class spread of adjacent vanes must not be exceeded.			0.000	0.040	

REF. NO.	DESCRIPTION	LIMITS MIN	LIMITS MAX	REPLACE IF OVER
904	1st Stage Turbine Vane Inner Mounting Bolt - (Do not use lubricating oil on this bolt during while assembly applying torque.)	45	50	
906	1st Stage Turbine Vane Outer Mounting Bolt. (Do not use lubricating oil on bolt during assembly while applying torque)	55	60	
922	Diffuser Case Rear Flange Combustion Chamber Outer Case (Retaining Bolts) Do not use lubricating oil on these bolts during assembly torquing.	67	75	
937	Fuel Nozzle Support (Retaining Bolt)	65	85	

C. Combustion Section Fits and Clearance: JT8D-15,-15A,-17, -17A,-17R,-17AR
See Figure 605.

REF. NO.	DESCRIPTION	REF. DIMENSIONS MIN	REF. DIMENSIONS MAX	LIMITS MIN	LIMITS MAX	REPLACE IF OVER
1	Case - Combustion Chamber Inner, Assembly of	13.298	13.302			
	Housing - No. 5 Bearing	13.298	13.302	.004	.004T	
2	Case - Combustion Chamber Inner, Assembly of	13.508	13.510			
	Support - Turbine Stator, Assembly of	13.506	13.508	.000	.004T	
3	Pin - No. 5 Bearing Seal	.220	.221			
	Support - No. 5 Bearing Seal	.219	.220	.000	.002T	
4	Shield - Heat No. 4 and 5 Bearing, Inner, Assembly of	10.493	10.495			
	Housing - No. 5 Bearing	10.497	10.503	.002	.010	
5	Support - No. 5 Bearing Seal, Assembly of	10.492	10.496			
	Housing - No. 5 Bearing	10.497	10.503	.001	.011	
6	Gap Seal Ring - Metal Gap: .015-.020 At 6.191 Gage Diameter					
	Housing - No. 5 Bearing	6.190	6.193	.012	.026	

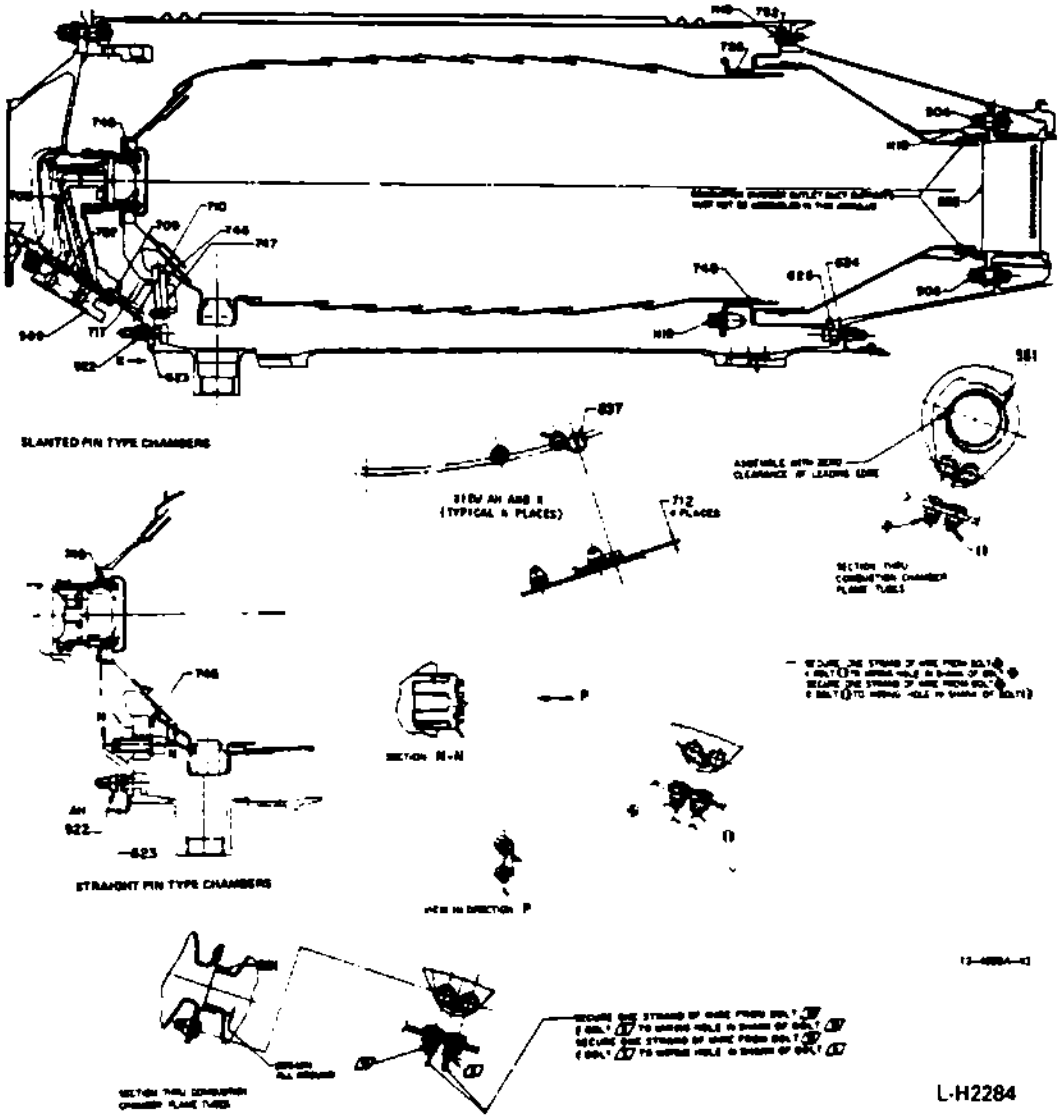
REF. NO.	DESCRIPTION	REF. DIMENSIONS MIN	REF. DIMENSIONS MAX	LIMITS MIN	LIMITS MAX	REPLACE IF OVER
7	Side Clearance Seal Ring - Metal	.1525	.1540			
	Seal Ring Holder - No. 5 Bearing	.157	.160	.003	.0075	
8	Seal - Air, Turbine, Inner, 1 Stage	16.264	16.268			
	Support - Turbine Stator, A Assembly of	16.264	16.268	.004	.004T	
9	Case - Turbine	29.842	29.846			
	Case - Combustion Chamber, Outer, Assembly of	29.838	29.842	.000	.008T	
10	Case - Turbine	29.663	29.667			
	Support - Combustion Chamber, Assembly of	29.669	29.675	.002	.012	
11	Chamber - Combustion, Assembly of	6.230	6.236			
	Guide - Combustion Chamber	6.240	6.244	.004	.014	
12	Case - Combustion Chamber Inner, Assembly of	13.508	13.510			
	Combustion Chamber, Support Assembly PN 702689-C and later	13.500	13.508	.000	.010T	
		13.510	13.518	.000	.010	
13	Guide - Combustion Chamber	6.387	6.397			
	Support - Combustion Chamber, Assembly of	6.397	6.407	.000	.020	

REF. NO.	DESCRIPTION	REF. DIMENSIONS MIN	REF. DIMENSIONS MAX	LIMITS MIN	LIMITS MAX	REPLACE IF OVER
14	Gap Seal Ring - Metal Gap: .032-.042 at 7.814 Gage Diameter Housing - No. 5 Bearing	7.814	7.815	.032	.045	
15	Side Clearance Seal Ring - Metal	.0935	.0945			
	Damper - No. 5 Bearing	.0955	.0975	.001	.004	
16	Axial Fit Damper - No. 5 Bearing To Plate - Retaining, Bearing, No. 5			.0025	.0105	
17 A	Side Clearance: Damper, No. 5 Bearing	.359	.361			
	Housing No. 5 Bearing (Other Than PN 711573, 725537)	.377	.383	.016	.024	
	Housing, No. 5 Bearing (PN 711573, 725537)	.385	.391	.024	.032	
18	Damper - No. 5 Bearing	7.798	7.799			
	Housing - No. 5 Bearing	7.814	7.815	.015	.017	
19	(For Retainers Not Secured To Supports With Screws.) Plate - Retaining Bearing, No. 5	8.840	8.843			
	Support - No. 5 Bearing Seal, Assembly of	8.837	8.840	.000	.006T	

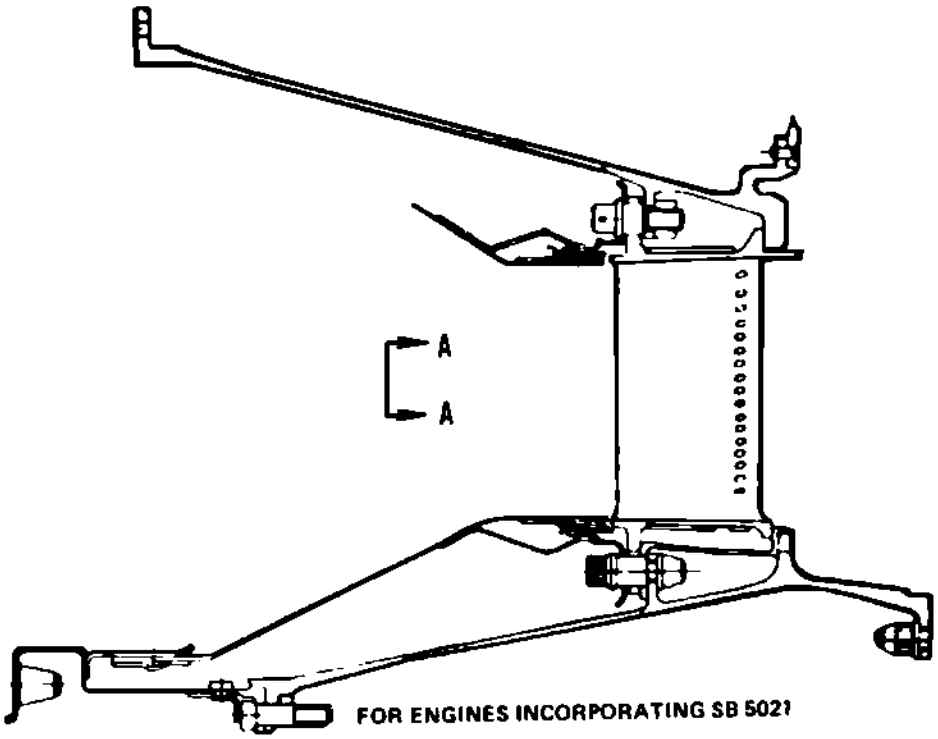
REF. NO.	DESCRIPTION	REF. DIMENSIONS MIN	REF. DIMENSIONS MAX	LIMITS MIN	LIMITS MAX	REPLACE IF OVER
20	Seal Ring Holder - No. 5 Bearing Support - No. 5 Bearing Seal, Assembly of	6.669 6.671	6.670 6.672	 .001	 .003	
21	Seal - Air, Turbine 1 Stage Support - Turbine Rotor Cooling Air Duct	17.068 17.068	17.072 17.072	 .004	 .004T	
22	Duct - Cooling Air, Turbine Rotor, 1 Stage Assembly of Support - Turbine Rotor Cooling Air Duct	15.519 15.513	15.521 15.517	 .002T	 .008T	
23	Duct - Cooling Air, Turbine Rotor, 1 Stage Assembly of Support - Turbine Stator, Assembly of	15.531 15.435	15.433 15.437	 .002	 .006	
24	JT8D-15A,-17A And -17AR: Vanes Can Be Shifted Circumferentially To Meet Mismatch Limits At Any Vane. Adjacent Vane 3 Class Spread Must Be Maintained.			.000	.040	

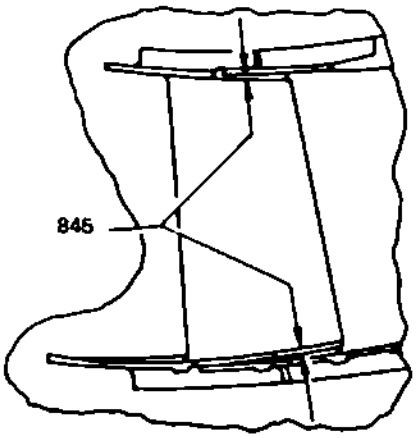
REF. NO.	DESCRIPTION	REF. DIMENSIONS MIN	REF. DIMENSIONS MAX	LIMITS MIN	LIMITS MAX	REPLACE IF OVER
101	Bolt - 1st Stage Turbine Vane Inner Mounting			45	50	
	NOTE: Do not use lubricating oil on this bolt during assembly while applying torque.					
102	Bolt - 1st Stage Turbine Vane Outer Mounting			55	60	
	NOTE: Do not use lubricating oil on this bolt during assembly while applying torque.					
103	Bolt - Turbine Stator Support To Inner Combustion Case and No. 5 Bearing Housing Bolt - No. 4 & 5 Bearing Heatshield To No. 5 Bearing Housing And No. 5 Bearing Seal			75	85	
	NOTE: Do not use lubricating oil on these bolts during assembly while applying					

REF. NO.	DESCRIPTION	REF. DIMENSIONS MIN	REF. DIMENSIONS MAX	LIMITS MIN	LIMITS MAX	REPLACE IF OVER
(CONTINUED)						
	torque.					
104	Plug - No. 5 Bearing Nozzle				50	
	NOTE: Assembly Plug flush to .020 below surface "A"					
150	No. 5 Bearing Seal Spring at: 0.800 inches			1.375	1.625	1.250
	For PN 707497 No. 5 Bearing Seal Spring at:					
	1.100 inches			.381	.419	
	.680 inch			1.463	1.538	
200	See Tables 403 and 404.					
201	See Table 404.					
206	Not Required for Maintenance					
207	Not Required for Maintenance					
208	Not Required for Maintenance					
350	Not Required for Maintenance					
351	Not Required for Maintenance					
352	Not Required for Maintenance					
353	Not Required for Maintenance					



JT8D-1,-1A,-1B,-7,-7A,-7B,-9,-9A
Combustion Section Clearance
Chart (12-4000A-43)
Figure 601
(Task 72-40-00-990-002)





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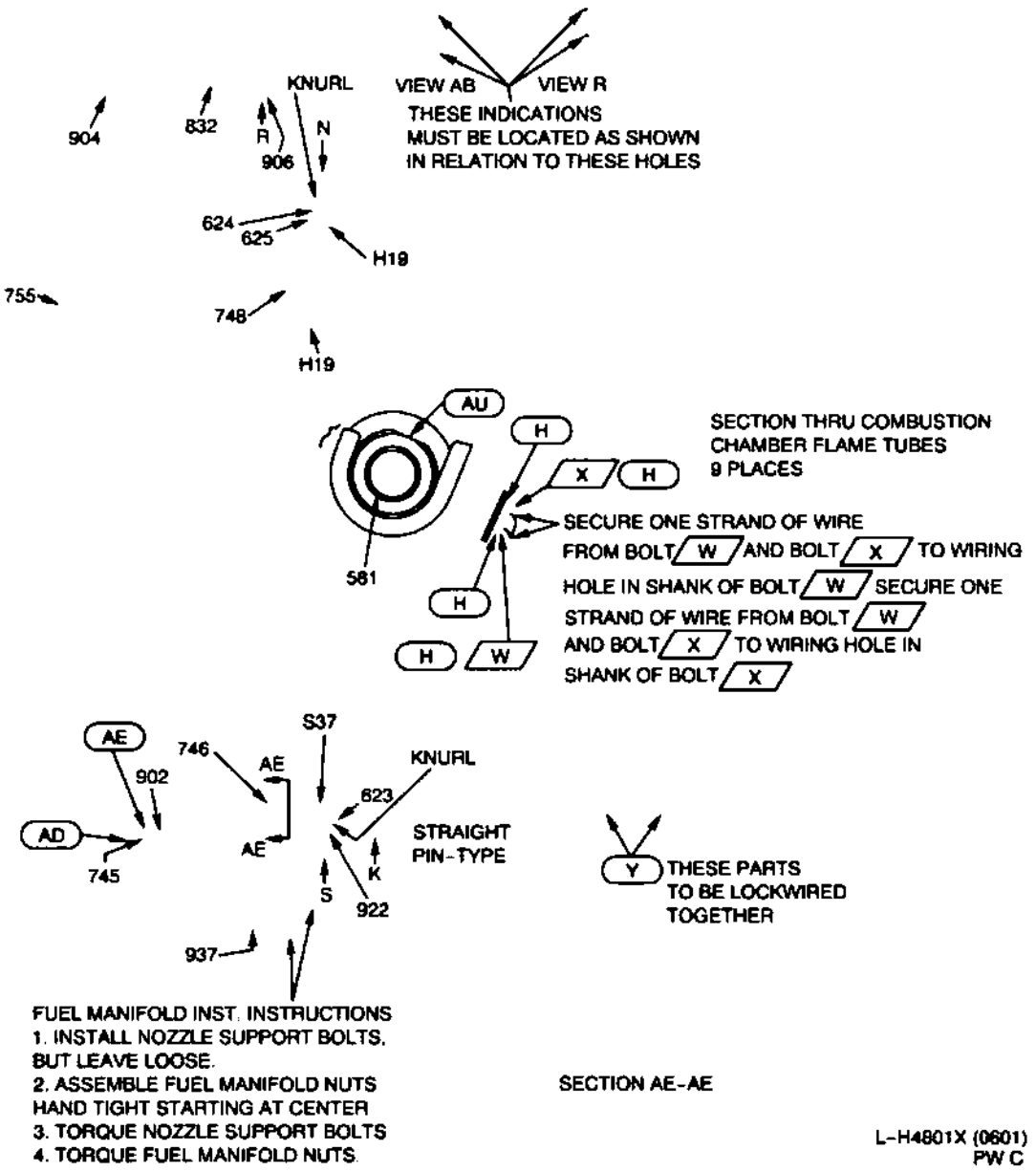
JT8D-1,-1A,-1B,-7,-7A,-7B,-9,-9A
Combustion Section Clearance Chart
Figure 602
(Task 72-40-00-990-002)



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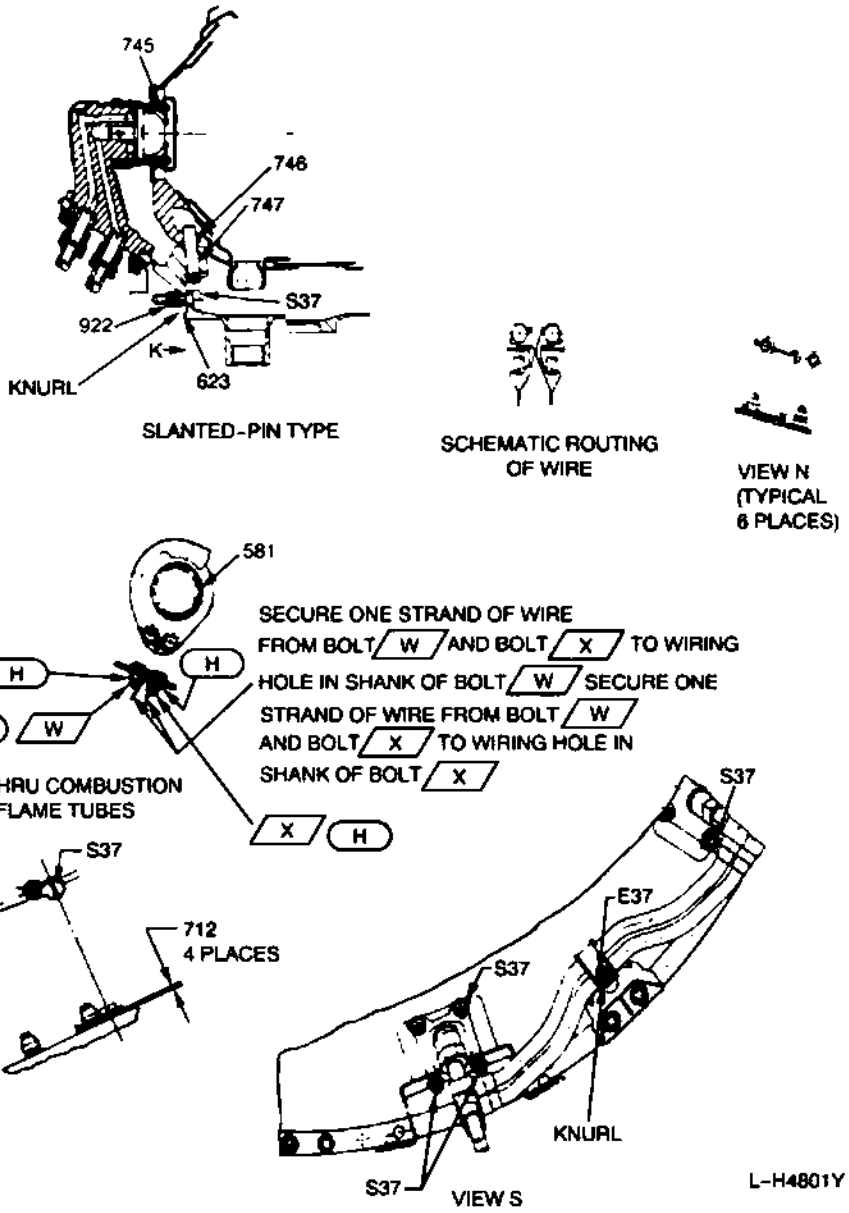
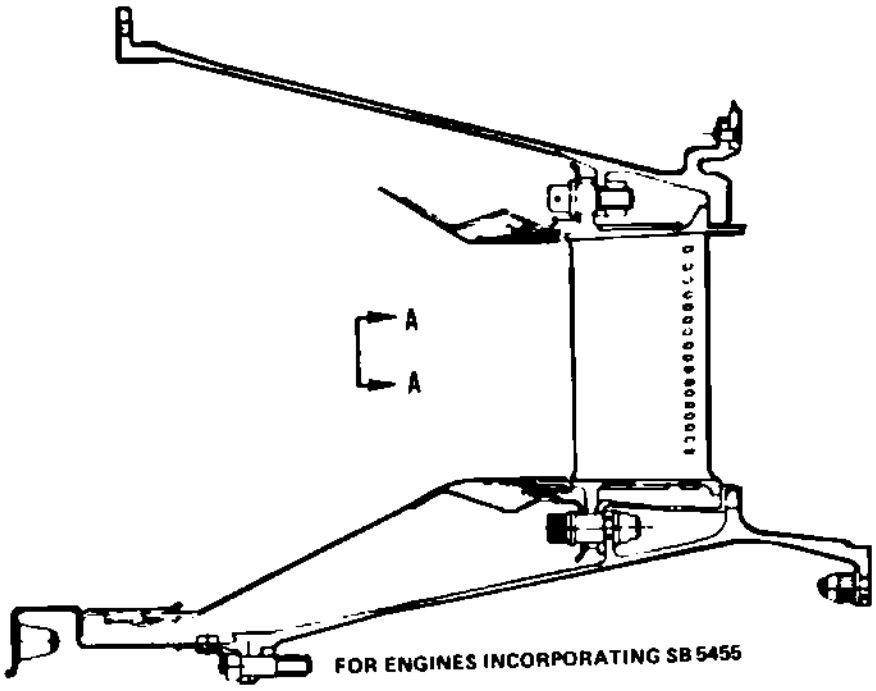
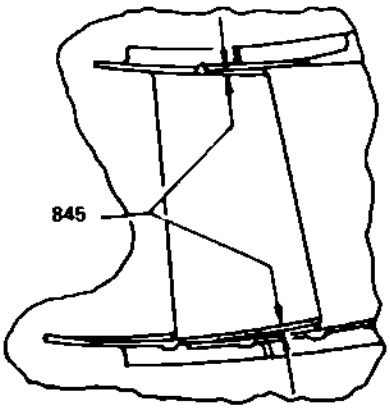
PW C

JT8D-11 Combustion Section
Clearance Chart (3-4000A-68)
Figure 603 (Sheet 1)
(Task 72-40-00-990-002)



JT8D-11 Combustion Section
Clearance Chart (3-4000A-68)
Figure 603 (Sheet 2)
(Task 72-40-00-990-002)





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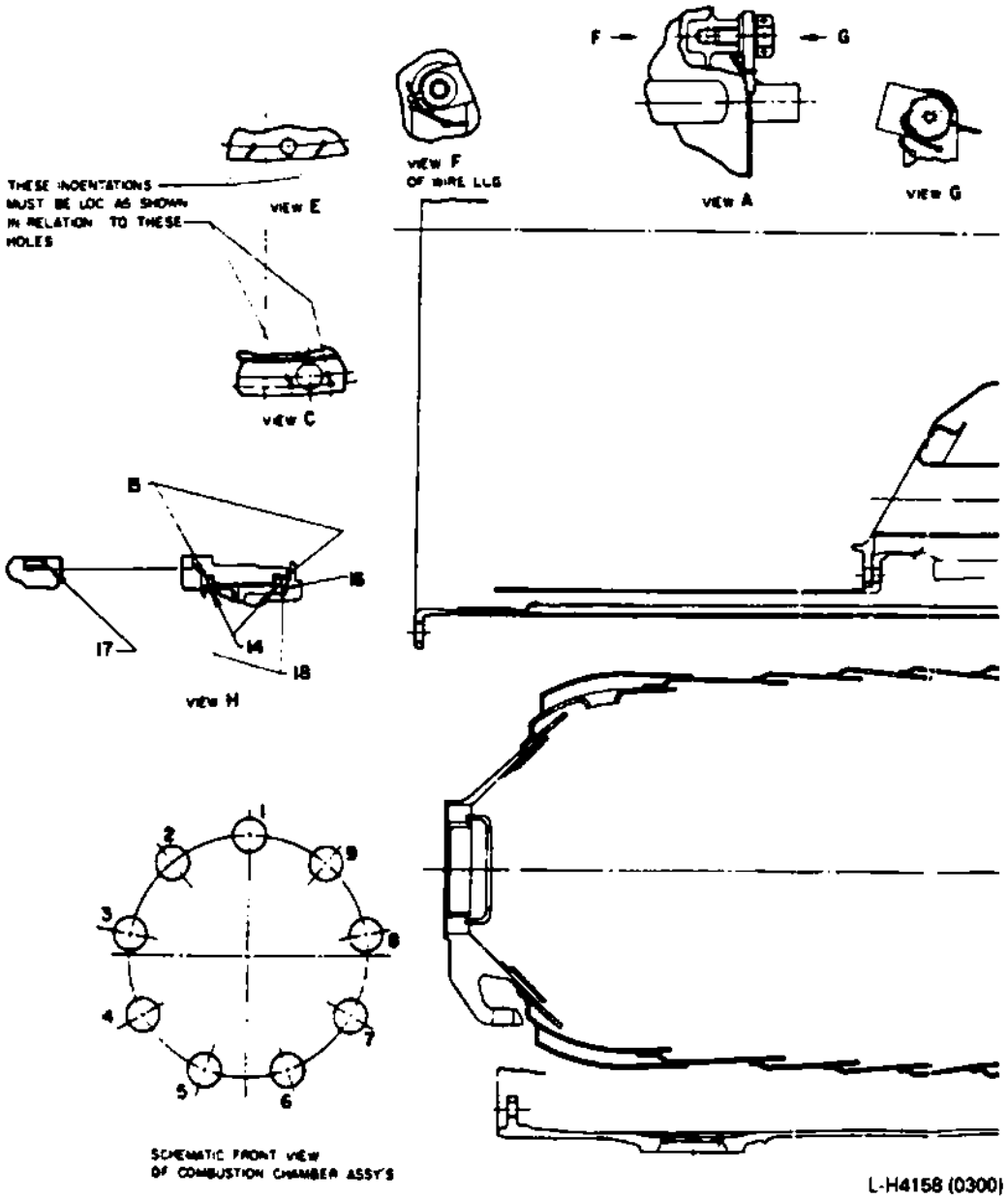
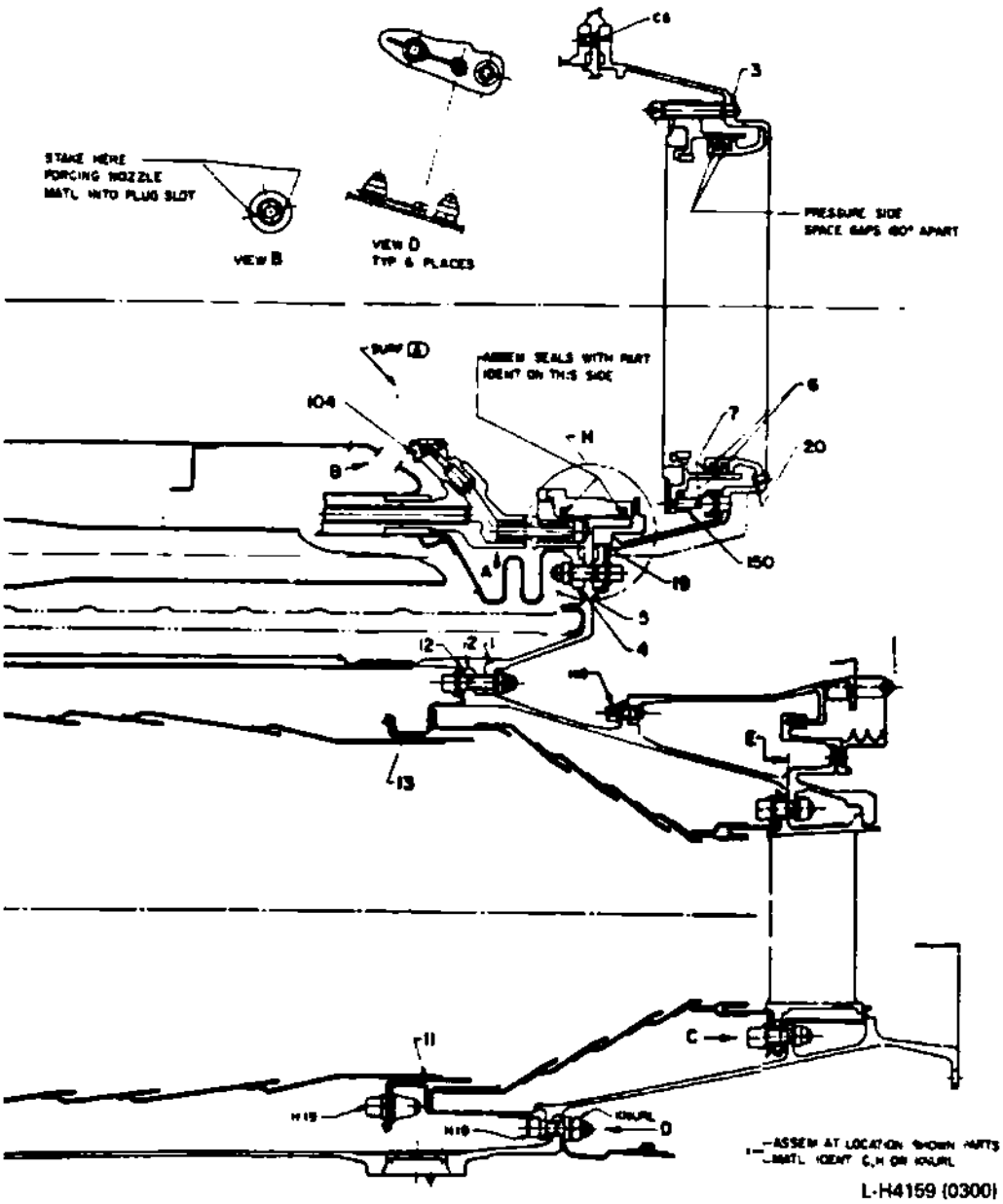
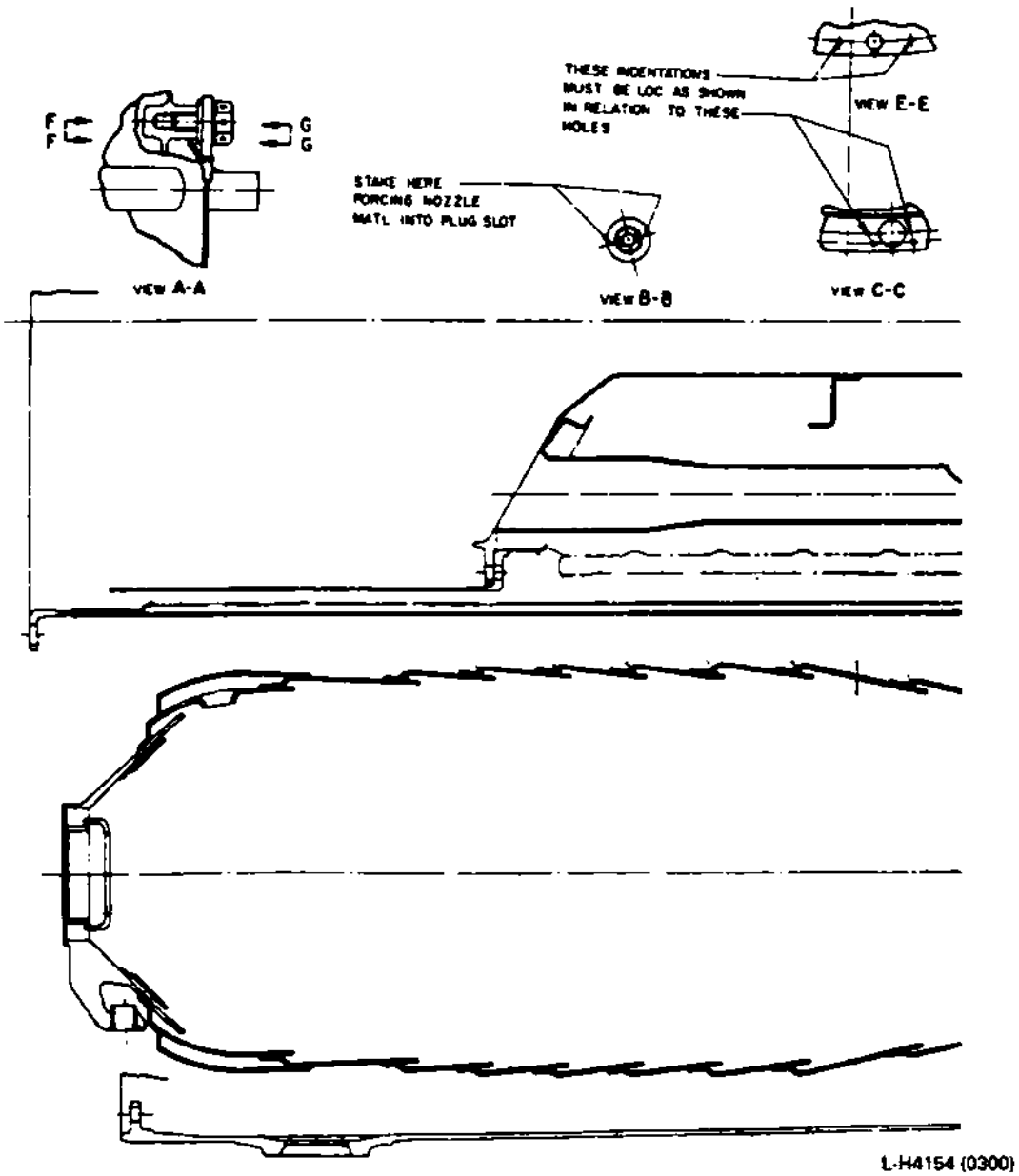
JT8D-11 Combustion
Section Clearance Chart
Figure 604
(Task 72-40-00-990-002)



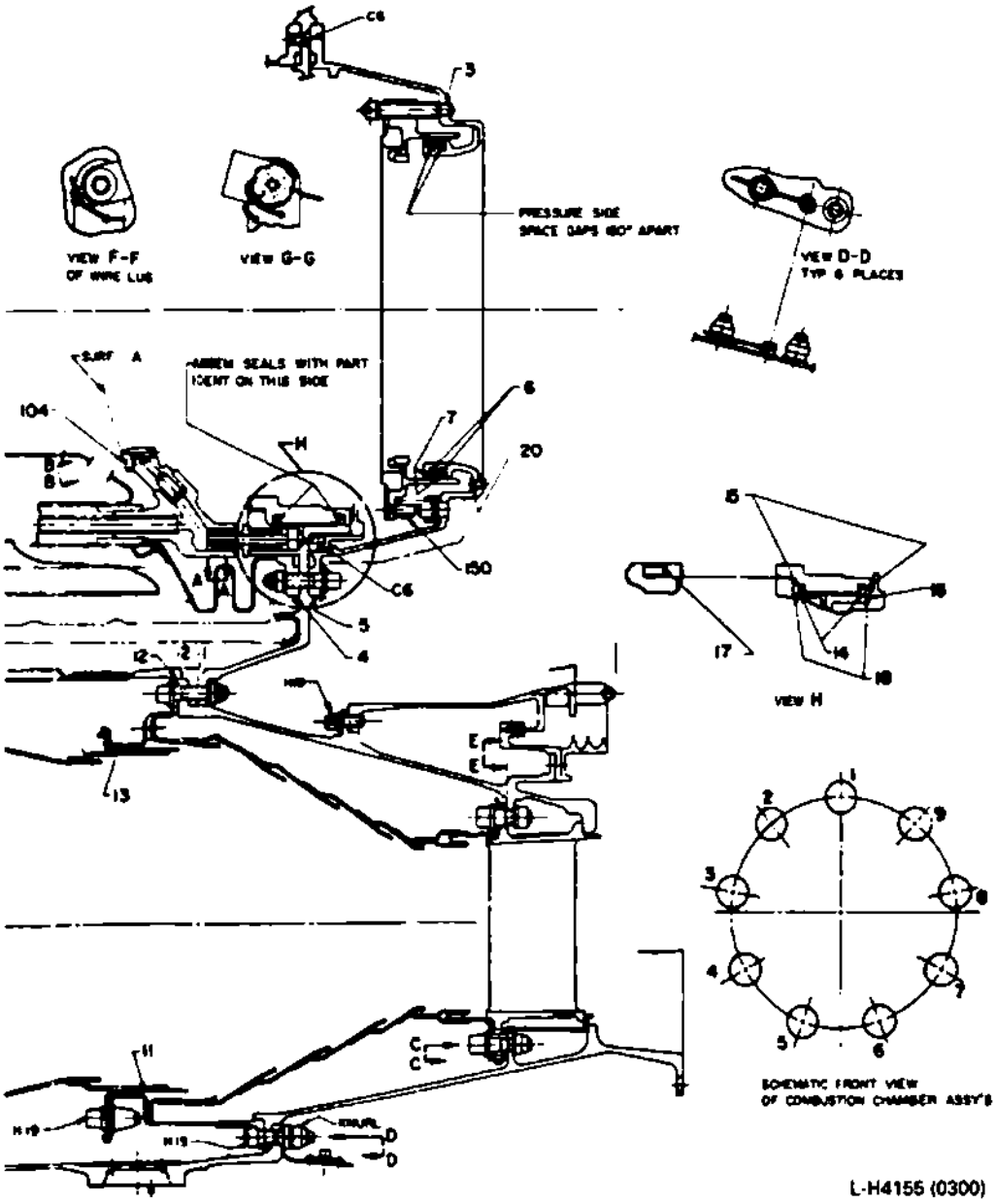
JT8D-15,-15A Combustion
Section Clearance Chart
Figure 605 (Sheet 1)
(Task 72-40-00-990-002)



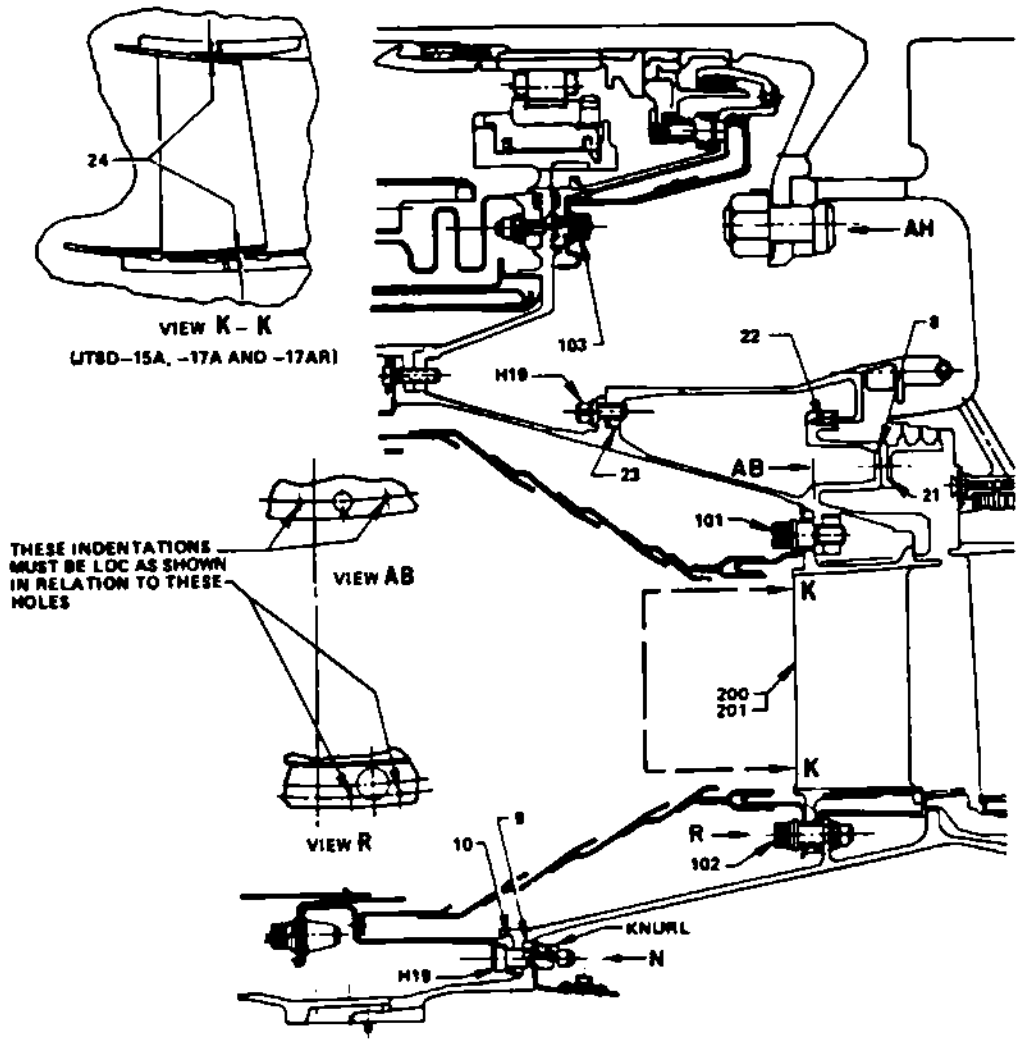
JT8D-15,-15A Combustion Section Clearance Chart
Figure 605 (Sheet 2)
(Task 72-40-00-990-002)



JT8D-17,-17A,-17R,-17AR Combustion
Section Clearance Chart
Figure 605 (Sheet 3)
(Task 72-40-00-990-002)

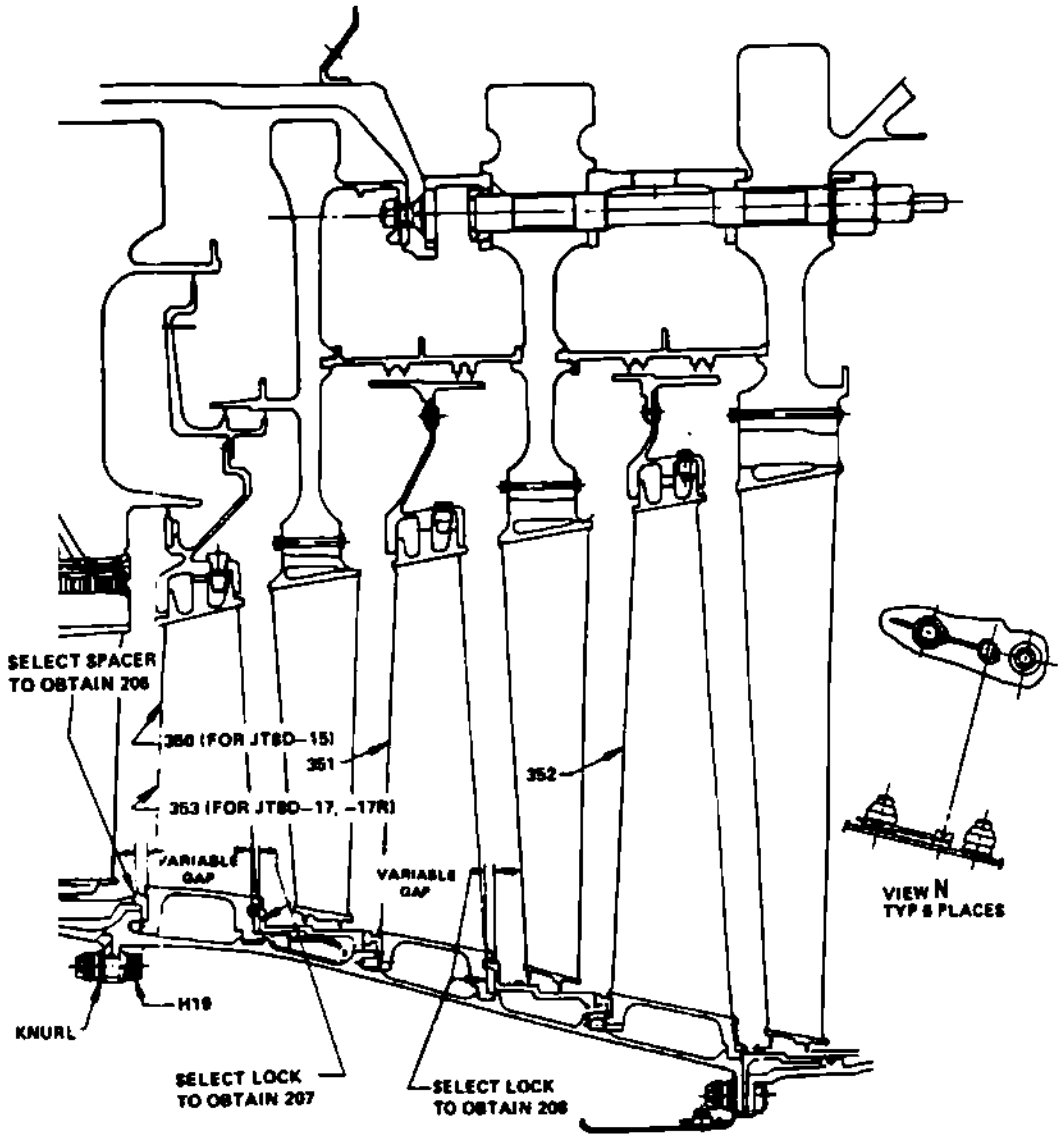


JT8D-17,-17A,-17R,-17AR Combustion
Section Clearance Chart
Figure 605 (Sheet 4)
(Task 72-40-00-990-002)



L-H4156 (0300)

JT8D-15,-15A,-17,-17A,-17R,-17AR
Combustion Section Clearance Chart
Figure 605 (Sheet 5)
(Task 72-40-00-990-002)



JT8D-15,-15A,-17,-17A,-17R,-17AR
Combustion Section Clearance Chart
Figure 605 (Sheet 6)
(Task 72-40-00-990-002)

COMBUSTION AND NO. 5 BEARING SECTION - DESCRIPTION-00

Task 72-41-00-990-001:

1. Combustion Chamber Outer Case

   A. The combustion chamber outer case is secured to the rear flange of the diffuser case and the front flange of the turbine nozzle case and encloses the combustion chamber. It forms the inner wall of the annular duct at this location.

   B. The fuel drain valves are located on the bottom centerline of the case, one at the front and one at the rear. A fuel drain manifold carries any drain fuel to outside of outer duct. Both flanges of this case turn inward and the front flange is scalloped. Two bosses, each with a single threaded hole, are located at the four and eight o'clock positions near the front of the case. The case is constructed of corrosion and heat resistant steel, with nickel-cadmium and baked-on aluminum enamel at the flanges to ensure against corrosion.

Task 72-41-11-220-001:

1. Combustion Chamber Outer Case Inspection

A. Combustion Chamber Outer Case Rear Flange And Bosses

(1) Special inspections are necessary for the combustion chamber outer case Ps4 boss, fuel drain bosses, and rear flange. These inspections are collected in two Alert Service Bulletins, as follows:

(a) For combustion chamber outer case PN 490547, 542155, 616315, 728829, 728829-001, 730413, 730413-001, 730414, 730414-001, 767197, 767279, and 767279-001, refer to ASB6228 for necessary inspections.

(b) For combustion chamber outer case PN 796761, 796761-002, 796761-003, 805412, 805412-001, 805412-002, 806675, 806675-001, 806675-002, 808125, 808125-001, and 808125-002, refer to ASB6230 for necessary inspections.

(c) For combustion chamber outer case PN 806748 there are no special inspections necessary.

COMBUSTION CHAMBERS - DESCRIPTION-00

Task 72-41-14-990-002:

1. Combustion Chambers

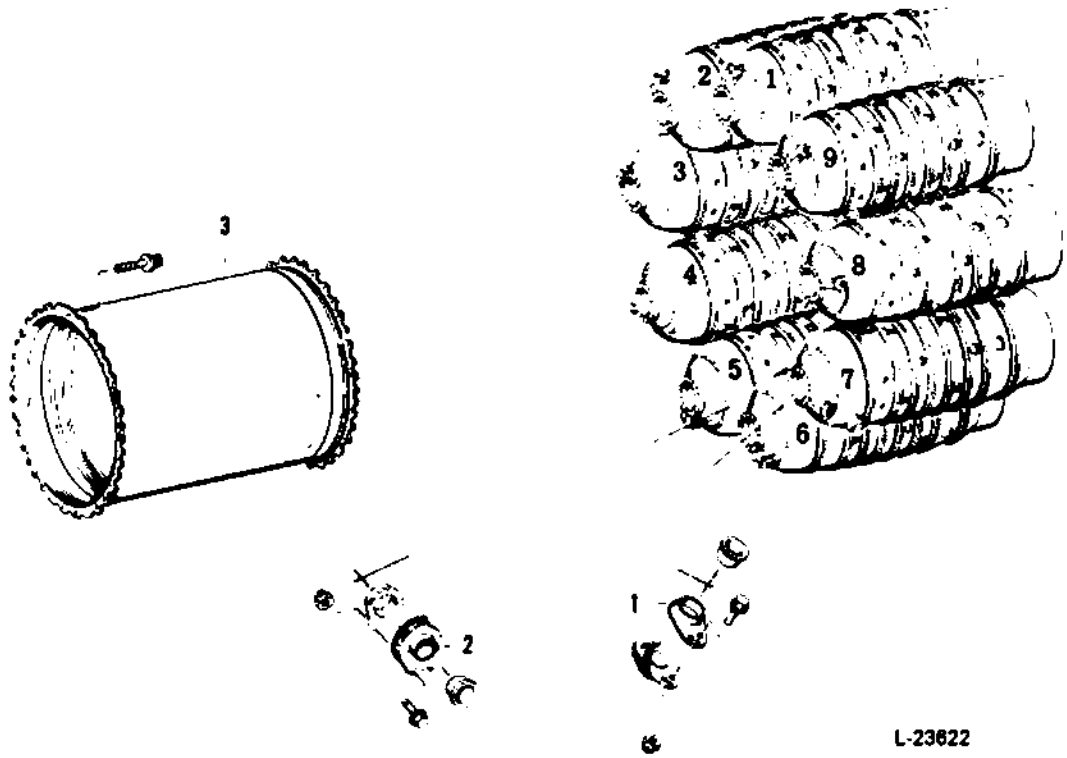
See Figure 1.

A. Nine one piece combustion chambers (or cans) are located between the combustion chamber outer case and the combustion chamber inner case in a can-annular arrangement. Chamber Number 1 is at the 12 o'clock position and the chambers are numbered clockwise around the engine as viewed from the rear.

B. Each complete bullet-shaped combustion chamber is of welded construction, having a series of round liners. The chambers are equipped with positioning brackets.

C. The rear of the chambers fits into the nine openings in the front of the combustion chamber rear support. The chambers fit onto the nozzle of the fuel manifold at the front, where they are held by lockwired bolts and pins through the positioning brackets. Interconnecting flame tubes between the chambers serve to spread the flame uniformly to all the chambers.

D. All the chambers have one male and one female flame tube. In addition, chambers four and seven have a spark igniter opening. Nine two-bolt interconnector tubes connect the male and female flame tubes of the chambers. The chambers are equipped with cooling deflectors (or air scoops) at the flame tubes.



1. Interconnector Tube, 8 Places
2. Interconnector Tube - Chambers 5 To 6
3. Combustion Chamber Inner Case

Combustion Chambers and
Combustion Chamber Inner Case
Figure 1
(Task 72-41-14-990-002)

Task 72-41-14-990-001:

1. Combustion Chambers - Removal/Installation See Section 72-40-00, COMBUSTION SECTION - REMOVAL/INSTALLATION

Task 72-41-14-220-001:

2. Combustion Chamber Inspection

A. Combustion Chambers Prior To Low Emissions Type. See Figures 201 through 203.

NOTE: Consult Alert Service Bulletin No. 5639 for detailed combustion chamber limits and procedures. ASB 5639 groups combustion chambers into categories based on extent of weld repairs accomplished. Certain categories of repaired chambers may be operated for extended hour and cycle intervals in service compared to other categories.

(1) Initial inspection intervals for combustion chambers are listed in ASB 5639.

(2) Repetitive inspection intervals are listed in Tables 201 and 202.

NOTE: See ASB 5639 for definition of combustion chamber categories.

(3) Three inspection methods are available for accomplishing combustion chamber inspection:

(a) Borescope method (see Section 72-00-00, Inspection/Check).

(b) Radiographic isotope method (see Section 72-00-00, Inspection/Check).

(c) Visual method (hot section inspection) (see Section 72-40-00, Inspection/Check).

NOTE: Visual method consists of removing combustion chambers and visually inspecting all liners for evidence of cracks or burning. Inspection shall provide sensitivity equivalent to that of either borescope or isotope methods. On smoke-reduction type combustion chambers 2nd to 3rd liner seam weld shall be inspected by X-ray as directed in this section or by use of borescope inserted

between external air scoop and 2nd liner, or by any other equivalent means.

Category	Summation Of Effective Circumferential Cracks In Any One Liner	Reinspection Hours*	Interval Cycles*
1A, 1B, 2A, 2B	0 through 3 Inches	3000	2000
3	0 through 3 Inches	2000	1500
1A, 1B, 2A, 2B, 3	Over 3 Inches through 6 Inches	1500	1000
1A, 1B, 2A, 2B, 3	Over 6 Inches through 8 Inches	250	200
1A, 1B, 2A, 2B, 3	Over 8 Inches	Remove or Nonrevenue Flight	Remove or Nonrevenue Flight

*Whichever occurs first.

Refer to Figure 203 for definition of effective circumferential crack length.

Reinspection Requirements
For Borescope Inspection
Table 201

(4) X-ray inspection (see Note above)

(a) Use Kodak M/AA or equivalent type 5 by 7 inches X-Ray film in 0.005 inch plastic holder.

(b) Place holder and 0.005 - 0.010 inch thick lead backing in chamber against 2nd liner as shown in Figure 201.

(c) Expose film from perpendicular distance to film of 48 inches for one minute using appropriate KV potential X-Ray source.

(d) Take series of four shots equally spaced around ID of chamber. First shot should have male crossover tube centered circumferentially.

(e) Examine developed film for circumferential cracking in area of 3rd liner cooling holes for crack repair.

(5) Combustion chamber features

(a) See Figure 202 for significant features of combustion chamber (reduced-smoke type chamber shown).

(6) Combustion chamber damage evaluation

(a) Evaluate damage to combustion chamber (other than circumferential cracks) per Table 203.

Category	Summation Of Effective Circumferential Cracks In Any One Liner	Reinspection Hours*	Interval Cycles*
All**	0 through 3 Inches	2000	1500
All**	Over 3 Inches through 6 Inches	1500	1000
All**	Over 6 Inches through 8 Inches	250	200
All**	Over 8 Inches	Remove or Nonrevenue Flight	Remove or Nonrevenue Flight

*Whichever occurs first.

**1A, 1B, 2A, 2B, and 3.

NOTE: Refer to Figure 203 for determination of effective crack circumferential crack length.

Reinspection Requirements
For Isotope Inspection
Table 202

(b) Evaluate circumferential cracking in combustion chamber per Figure 203.

B. Combustion Chambers Of Low-Emissions Type (SB 5650)

(1) Combustion chambers may be continued in service when the following conditions exist:

(a) Cracks less than 1/2 inch long emanating from cooling air holes.

(b) Radial or circumferential cracks less than 1/2 inch long extending from or around the crossover tubes or spark-igniter bosses.

(c) Slight out-of-round condition of the combustion chamber liners.

(d) Minor burning, discoloration or warpage.

(e) Slight distortion or burning of the cooling louver.

Condition	Recommendation
Axial Cracks (All Liners)	Cracks over 2 inches which intersect with circumferential crack one inch or more - Reinspect within 1500 Hours/1000 Cycles.
Missing Material (Holes in any Liner)	More than 0.500 x 0.500 inch or 0.25 sq-in. - Reinspect within 1500 Hours/1000 Cycles; more than 1.0 sq-in. to 1.5 sq-in. - Reinspect within 150 Hours/100 Cycles; more than 1.5 sq-in - Remove or nonrevenue flight.
Axial Misalignment of Adjacent	Misalignment over 0.150 inch - Reinspect within 50 Hours/Cycles.
Cross-Over Tubes	Misalignment over 0.250 inch - Remove or nonrevenue flight.
Cracked Air Scoop	Reinspect at next scheduled inspection mandated by other types of chamber distress noted (circumferential cracks, axial cracks, missing material or axial misalignment).

Combustion Chamber
Distress/Recommendations
Table 203

Condition	Recommendation
Liberated Air Scoop	Reinspect at 750 Hours/500 Cycles if liberated portion of scoop is captured on chamber and not contacting inner or outer combustion cases. If scoop is contacting either case, remove within 500 Hours/Cycles.

NOTE: Refer to Figure 203 for determination of effective axial and circumferential crack length.

Combustion Chamber
Distress/Recommendations
Table 203 (Continued)

(f) Cracks in the dome deflector are permitted if they are in the limits as follows: (See Figure 204).

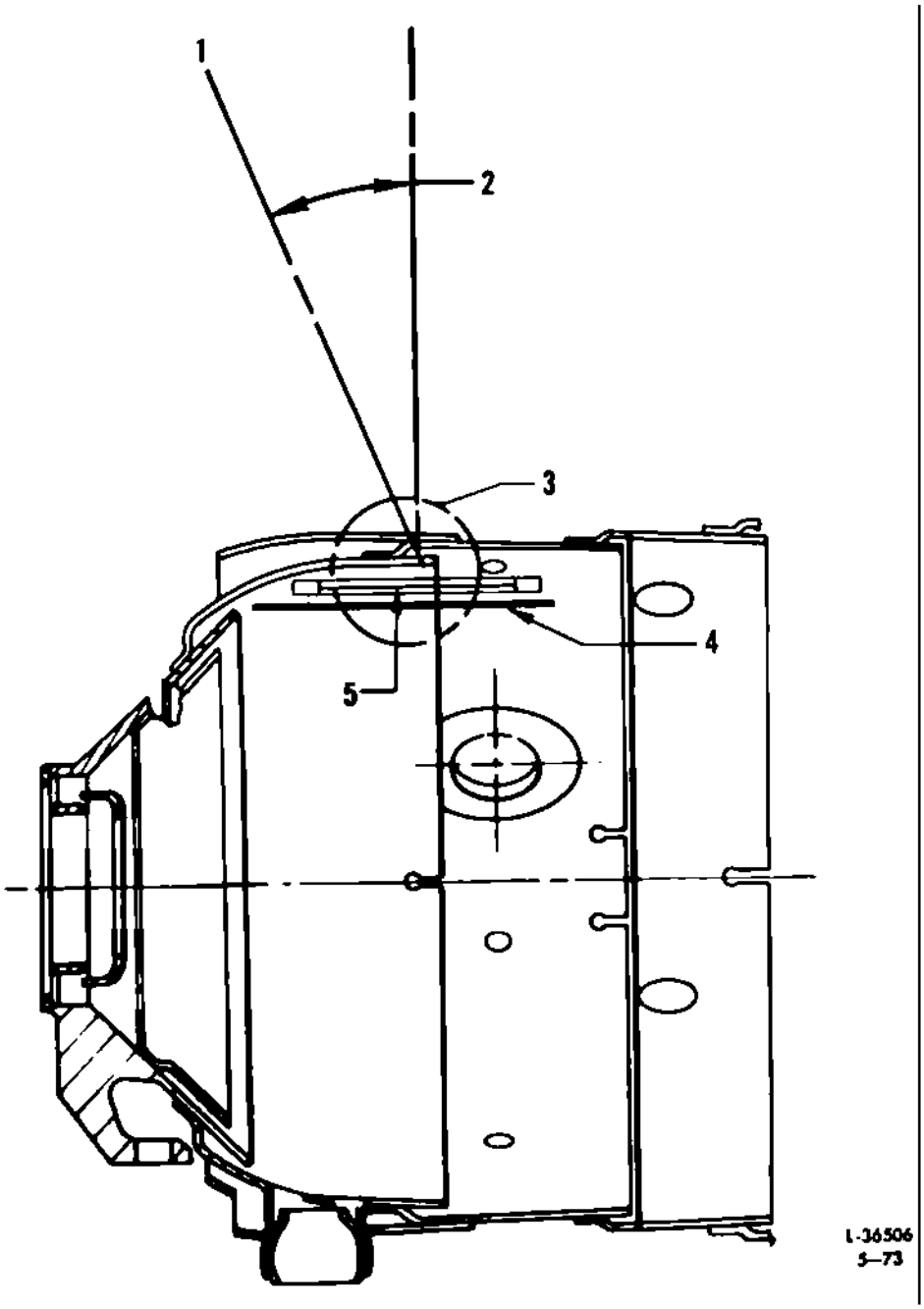
1 Cracks in the deflector are permitted if they do not go into the 0.100 inch area, as shown on figure.

2 Each chamber can have no more than 25 cracks in the deflector; there is no limit on the distance the cracks must be apart.

3 Cracks in the dome deflector that have no broken material are permitted.

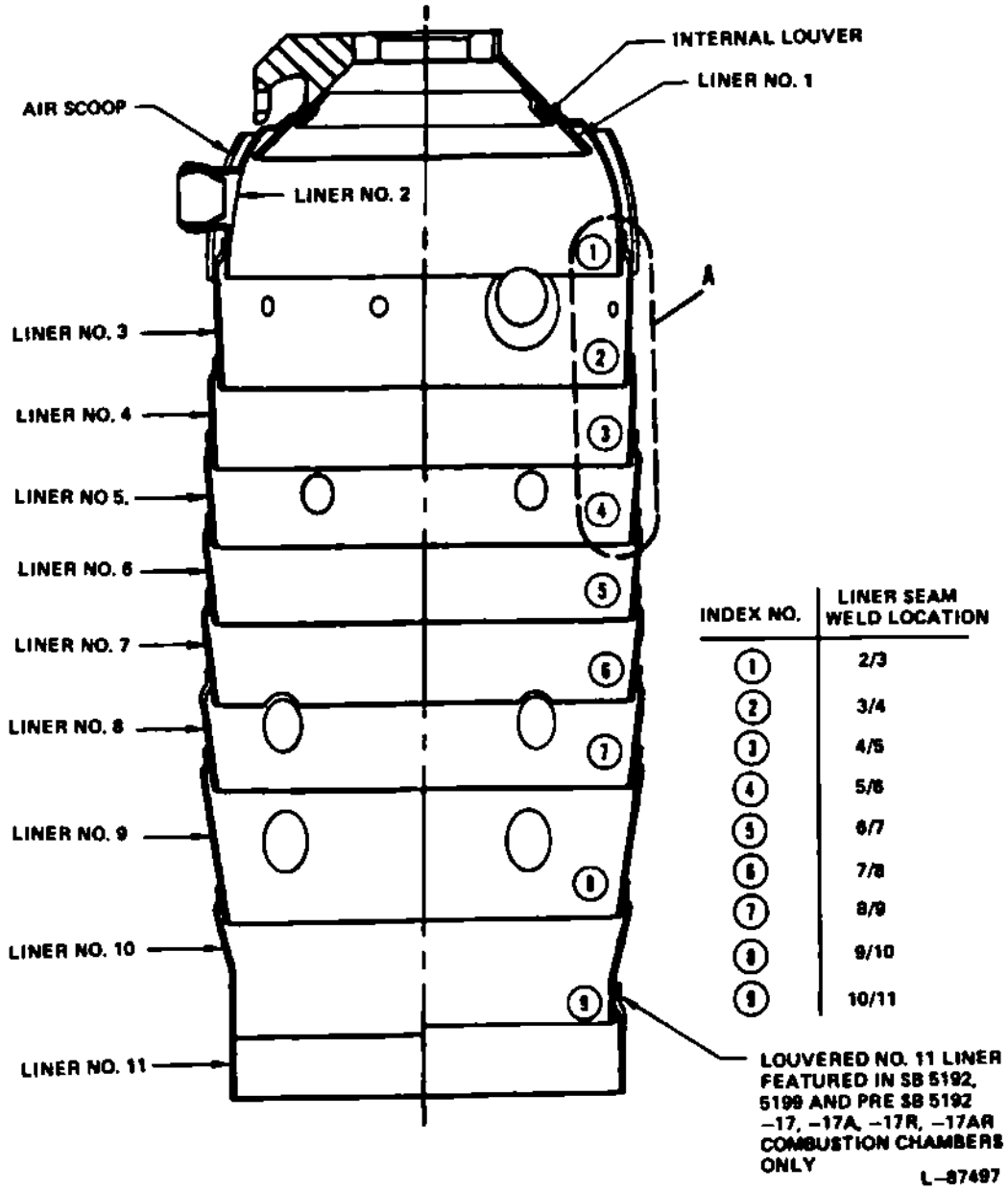
NOTE: Tell the Manager of Technical Support Group, Pratt & Whitney, 400 Main Street, East Hartford, CT 06018 if the chambers are rejected for limits more than those specified in step 2.B(1) (f).

NOTE: Combustion chambers which are removed from service should be forwarded to overhaul.

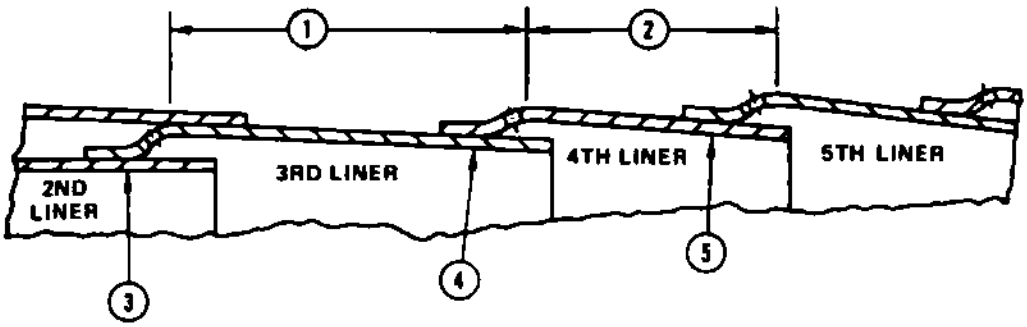


1. X-Ray Source
2. 25 - 30 Degrees
3. Inspection Area
4. Lead Backing
5. Film

Combustion Chamber
X-Ray Inspection
Figure 201
(Task 72-41-14-220-001)



Combustion Chamber Features
Figure 202 (Sheet 1)
(Task 72-41-14-220-001)



VIEW A
(ROTATED 90 DEGREES)

1. **3RD LINER – MEASURED FROM MAXIMUM DIAMETER OF THE 3RD LINER TO MAXIMUM DIAMETER OF THE 4TH LINER. ALL OTHER LINERS IDENTIFIED IN A SIMILAR MANNER.**
2. **4TH LINER**
3. **2ND TO 3RD LINER SEAM WELD JOINT**
4. **3RD TO 4TH LINER SEAM WELD JOINT**
5. **4TH TO 5TH LINER SEAM WELD JOINT**

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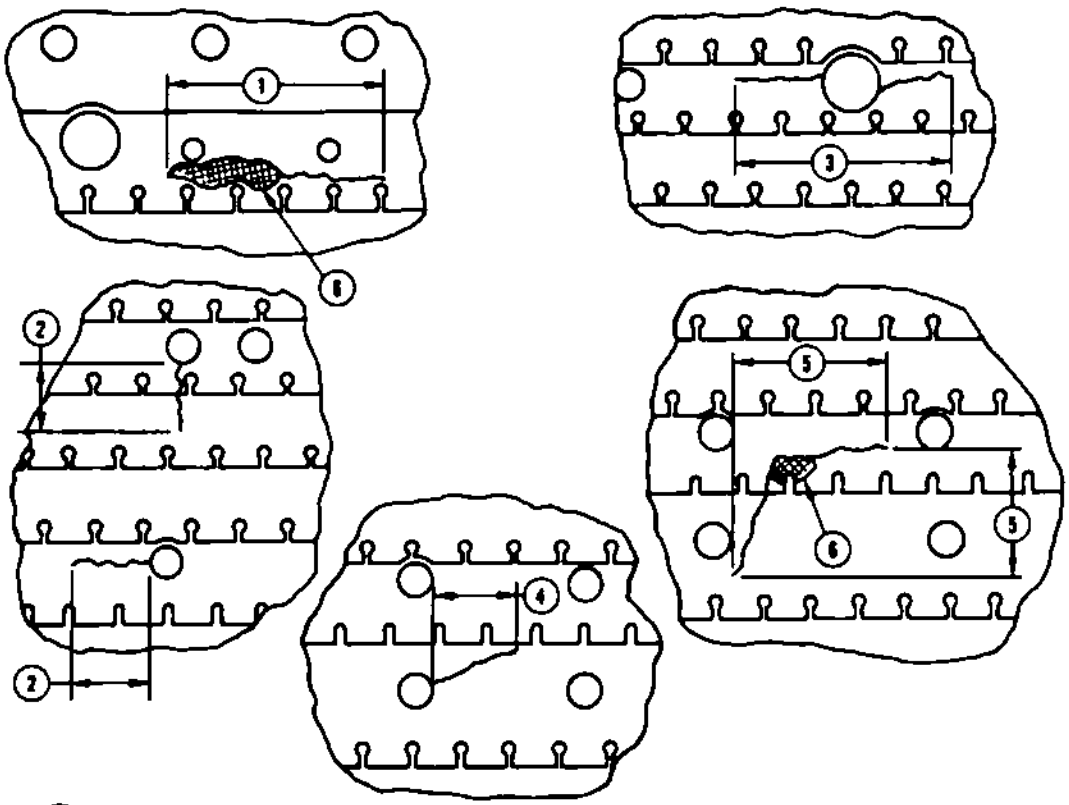
Combustion Chamber Features
Figure 202 (Sheet 2)
(Task 72-41-14-220-001)



1. EFFECTIVE CRACK LENGTH INCLUDES BURNED/OXIDIZED AREA PLUS THE LENGTH OF THE CRACK. SAME CRITERIA APPLY TO AXIAL CRACKS WHICH BEGIN OR END IN OXIDIZED/BURNED HOLE.
2. EFFECTIVE CRACK LENGTH DOES NOT INCLUDE THE SIZE OF A COMBUSTION HOLE.
3. EFFECTIVE CRACK LENGTH INCLUDES CHAMBER FEATURES, SUCH AS HOLES IF CRACKS PROGRESS IN BOTH DIRECTIONS, SAME CRITERIA APPLIES TO AXIAL CRACKS.
4. EFFECTIVE CRACK LENGTH OF DIAGONAL CRACKS DETERMINED BY PROJECTION TO CIRCUMFERENTIAL LENGTH.
5. DISPOSITION FOR COMPOUND CRACKING INTERSECTING MISSING MATERIAL IS MADE BY TREATING EACH CRACK MADE SEPARETLY, I.E. CIRCUMFERENTIAL AND AXIAL PROJECTED CRACK LENGTH AND HOLE SIZE BY COMPARING WITH THE MOST RESTRICTING INSPECTION AND/OR REMOVAL REQUIREMENT.
6. BURNED OUT, MISSING MATERIAL.

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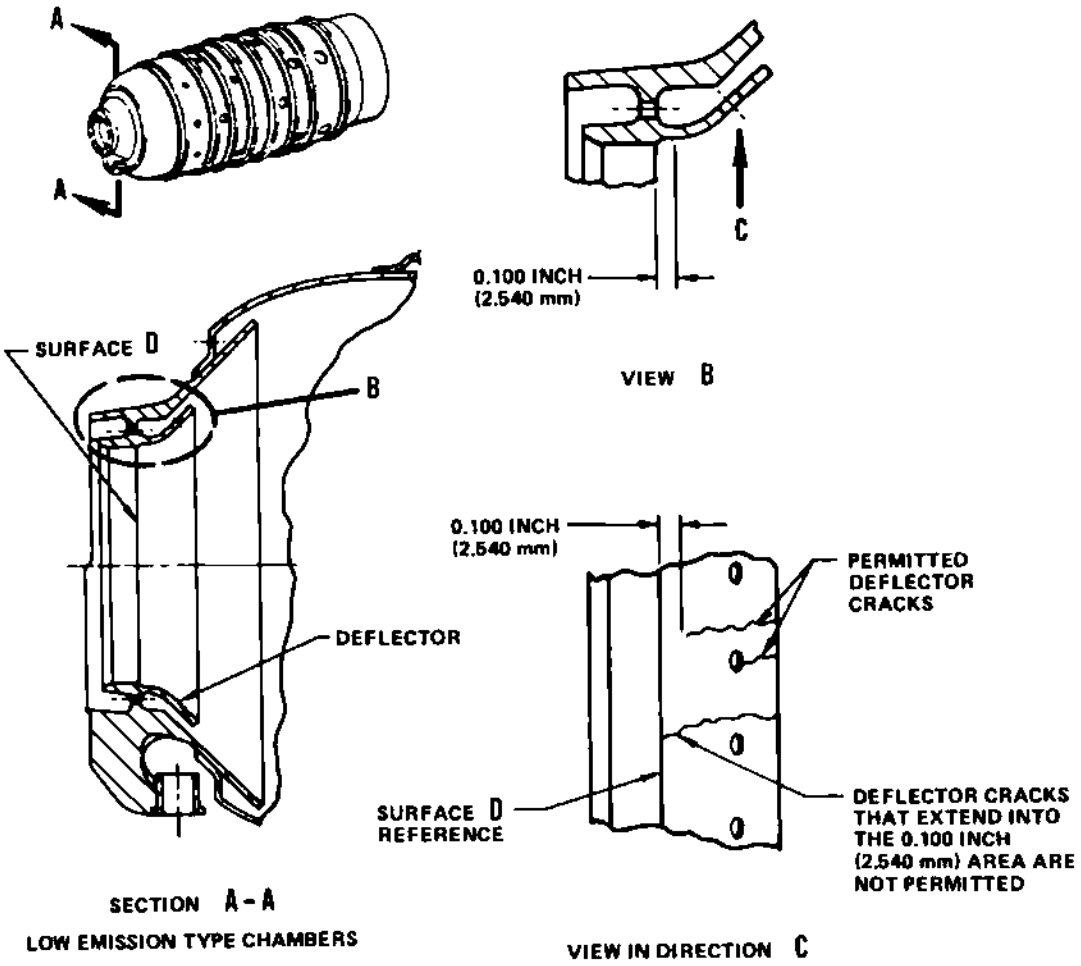
Effective Crack
Length Determination
Figure 203
(Task 72-41-14-220-001)



Deflector Crack Limits
Figure 204
(Task 72-41-14-220-001)

TURBINE AND EXHAUST SECTION - DESCRIPTION-00

Task 72-50-00-990-003:

1. Turbine and Exhaust Section Description

A. Turbine Section

(1) The turbine section consists of two outer cases, (turbine nozzle outer front case and turbine outer rear case) four stages of guide vanes, an inner case and seal and the turbine rotor with their drive shafts. There are four turbine rotor stages: a single (1st) stage which drives the rear (high pressure) compressor rotor and a three (2nd, 3rd, and 4th) stage unit which drives the front (low pressure) compressor rotor. In each stage of the turbine, nozzle vanes precede the turbine rotor blades and direct the flow of gas against the blades.

(2) The flow of hot gases must be accurately directed because the turbine blades are rotating at a high rate of speed, and an efficient operation calls for the hot gases to exert their forces as nearly as possible in the direction the blades are moving. The stream of gas must approach the path of the blades at a reasonably small angle relative to the plane of rotation of the rotor, and to have a velocity considerably greater than the blades, even faster than the blade tips.

(3) The guidance and regulation of the velocity and pressure ratio of the hot gases is the function of the nozzle guide vanes. The nozzle guide vanes (1st stage) must regulate the pressure ratio and velocity by the size of the total area of the gas path. Similarly, the rotating turbine blades of the rotors must have the proper size of total area of gas paths to accomplish the results desired.

B. Exhaust Section

(1) The turbine exhaust section collects and straightens the gas flow as it comes from the turbine and increases the velocity of the gases before they are discharged from the rear. The turbine exhaust case decreases in diameter from front to rear.

(2) Outside the turbine exhaust case is a fan discharge outer duct which handles the fan discharge air coming through the annular duct. Gas flow from the turbine section and fan discharge air are merged into one exhaust stream at this location.

(3) On engines which are equipped for additional noise reduction, a fan and turbine exhaust mixer is bolted to the rear of the fan exhaust outer duct and turbine exhaust case. This mixer is composed of convoluted sheet metal sections which combine the fan bypass air and primary gaspath exhaust, resulting in noise reduction.

Task 72-50-00-990-001:

1. First Stage Turbine Vanes Removal/Installation See Section 72-40-00, COMBUSTION SECTION - REMOVAL/INSTALLATION.

Task 72-50-00-210-001:

2. First Stage Turbine Vanes Inspection

See Figure 201.

A. General

(1) This section has information on how much subsequent inspection or maintenance will be necessary as a result of 1st stage turbine vane condition.

(2) This section is in two parts. Part 1 is for vanes which are examined on-wing by borescope or equivalent method. Part 2 has vane inspection procedures for when there is access to the combustion chamber (for example during a hot section inspection). Because of the different engine conditions, Parts 2 limits permit less deterioration compared to Part 1 limits.

(3) Because there can be many variables that can have an effect on vane durability, it is recommended that the guidelines in Part 1 be adjusted as a result of operator experience, or as a result of vane condition found at shop visits. Some factors that can have an effect on vane condition are:

(a) How lower engine ratings are used (if there is a small (or no) decrease in engine rating, there can be the most vane damage).

(b) Fuel nozzle cleaning (if the fuel nozzles are not cleaned while installed in the engine, there can be the most vane damage).

(c) N2 (can be lower than Data Plate limits if there are bowed vanes or other damage more than limits).

(d) Engine environment (operation at or above 85°F (30°C) can cause the most damage).

(4) White material splatter which looks like solder splatter (which is bright, thin, and random in shape or size), that is on the high pressure turbine vanes and blades is magnesium zirconium oxide. Magnesium zirconium oxide on these blades and vanes has no effect on the serviceability or the performance of the item that is splattered, and is therefore acceptable.

B. Part 1 Procedures (Inspection On-Wing, No Access To Vanes)

NOTE: These procedures are applicable to all engines (this includes performance-improvement engines, JT8D-1 thru -9A post-SB 5021 and JT8D-11 post-SB 5455).

(1) Leading edge burns and cracks which are not open into the internal cavity are permitted. These cracks usually look like black spots or axial lines, often with indentations at the leading edge of a vane. These cracks can show as streaks on the airfoil aligned with the crack.

NOTE: Vane damage in which vane material is burned away to the internal cavity of the vane begins as leading edge cracks. These cracks permit vane material to be burned through, until the vane airfoil material is gone ("vane burn-through"). This can subsequently cause high frequency excitation and fracture of the 1st stage turbine blades.

(2) Trailing edge cracks up to one half inch in length are permitted. See Figure 201 (Sheet 1).

(3) There is no limit on the number of leading or trailing edge cracks, or how near the cracks are to each other. Airfoil burns at the leading edge which do not apparently decrease the chord length are permitted. See Figure 201 (Sheet 2), View A.

(4) Schedule an engine for borescope inspection at increments of 700 hours or 500 cycles (whichever occurs first) when:

(a) Leading edge cracks extend to make "V"-shape holes not larger than 0.050 inch (in burned or not burned areas)

(b) Trailing edge cracks greater than one-half inch extend to 50 percent of the chord length. See Figure 201 (Sheet 1).

(c) Trailing edge material is burned away (with material missing) up to one-half inch along the airfoil axis and up to one and one-half inch along the span (length) of the trailing edge. See Figure 201 (Sheet 3).

(5) Schedule an engine for borescope inspection at increments of 500 hours or 350 cycles (whichever occurs first) when:

(a) There is leading or trailing edge burn damage or oxidation, or cracks that are more than the limits in step (4). See Figure 201 (Sheet 1).

(b) There are burns or oxidation on more than 50 percent of the leading edge span

(c) The vane chord is decreased until it is less than the limits in step (4).

(6) If vane material is burned through at the leading edge on the concave or convex side, schedule the engine for inspections by the size of the damage as follows (see (Sheet 3) of Figure 201):

(a) Airfoil burn-through up to 0.015 square inch (1/8 by 1/8 inch): each 400 hours or 250 cycles*

(b) Airfoil burn-through up to 0.0625 square inch (1/4 by 1/4 inch): each 250 hours or 150 cycles*

(c) Airfoil burn-through up to 0.250 square inch (1/2 by 1/2 inch): each 150 hours or 100 cycles*

*When the first of these occurs

(7) If there is vane burn-through which is more than 0.250 square inch (1/2 by 1/2 inch), but less than one square inch, schedule the engine for inspection again after the next 50 hours or 30 cycles, (when the first of these occurs). It is permitted to do an inspection again and again at these intervals, or to remove the engine for repair. If there is vane burn-through more than one square inch but less than two square inches,

it is permitted to operate the engine for ten hours or six cycles (when the first of these occurs).

(8) If there is vane burn-through which is more than the limits in step (7), or the inner or outer buttresses of a vane are separated, remove the engine or ferry the engine with a non-revenue flight.

(9) Tight cracks on the concave side of the vane airfoil are permitted if there are no burns or oxidation. These cracks are permitted to extend from the platform or the trailing edge cooling holes or slots and in any direction, but cannot connect with the trailing edge. It is possible for cracks to extend around the leading edge and connect with the leading edge cooling holes. See Figure 201 (Sheet 5).

(10) Oxidation damage to the platform is permitted. If vanes show this condition, examine the outlet duct surface immediately forward of the damaged vane also.

(11) The mating surfaces of vane buttresses are permitted to be not aligned ("vane mismatch") if this does not cause an opening of the cooling air cavity at the outer platforms. See Figure 201 (Sheet 6). If there is an opening, examine the area again at increments of 2000 hours or 1500 cycles (when the first of these occurs).

NOTE: Vane mismatch (vane platforms not aligned as shown in (Sheet 6) of Figure 201) of adjacent vanes aft of the cooling cavity is permitted up to 5/16 inch. Vanes in performance-improvement engines have extended rear outer vane platforms.

(12) Vanes which show cracks in the inner or outer platforms are permitted for continued operation. See Figure 201 (Sheet 7). There is no limit to the number or position of platform and/or platform-to-vane airfoil cracks. These cracks are shown to be of a type that releases internal stresses, and these cracks do not cause material to break out of the vane or platform or cause problems with engine operation.

NOTE: Make sure that vanes with the damage referred to above are inspected by engine manual procedures when these vanes are removed from the engine.

(13) Convex Side Cooling Hole Crack Limits See Figure 202.

(a) Crack limits for PN 737271, 798771, 805771, vanes and for PN 794471 vanes (JT8D-15A,-17A,-17AR typical) engines with convex side cooling holes are as follows:

1 Cracks which extend from the two rows of cooling holes on the convex airfoil surface are permitted as shown in Figure 202 and as follows:

NOTE: If vanes are found to have cracks which are not in the limits that follow, it will be necessary to remove the vanes for repair.

a Axial and diagonal cracks (no limit to the number) which extend from the cooling holes are permitted.

b A maximum of six adjacent holes in a row of cooling holes are permitted to be connected by a single crack.

c Cracks connecting three or more holes forming a closed loop are not permitted.

C. Part 2 Procedures (Combustion Section Open, With Access To Vanes)

NOTE: These procedures are applicable to all engines (this includes performance-improvement engines, JT8D-1 thru -9A post-SB 5021 and JT8D-11 post-SB 5455).

(1) Examine the vanes for cracks, bowed airfoils, burns or oxidation as follows:

(a) Leading edge burns and cracks which are not open into the internal cavity are permitted. These cracks usually look like black spots or axial lines, often with indentations at the leading edge of a vane. These cracks can show as streaks on the airfoil, aligned with the crack.

NOTE: Vane damage in which vane material is burned away to the internal cavity of the vane begins as leading edge cracks. These cracks permit vane material to be burned through, until the vane airfoil material is gone ("vane burn-through"). This

can subsequently cause high frequency excitation and fracture of the 1st stage turbine blades.

(b) Trailing edge cracks up to one half inch in length are permitted.

(c) There is no limit on the number of cracks, or how near the cracks are to each other. Airfoil burns at the leading edge which do not apparently decrease the chord length are permitted. See (Sheet 2) of Figure 201, View A.

(d) Tight cracks on the concave side of the vane airfoil are permitted if there are no burns or oxidation. These cracks are permitted to extend from the platform or the trailing edge cooling holes or slots and in any direction, but cannot connect with the trailing edge. Cracks can extend around the leading edge and connect with leading edge cooling holes. See Figure 201 (Sheet 5).

(e) Oxidation damage to the platform is permitted. If vanes show this condition, examine the outlet duct surface immediately forward of the damaged vane also.

(2) Convex Side Cooling Hole Crack Limits (JT8D-15,-15A,-17,-17A,-17R,-17AR) See Figure 202.

(a) Crack limits for PN 737271 vanes and for vanes used in JT8D-15,-17A, and -17AR engines (with leading edge cooling holes) are as follows:

1 Cracks which extend from the two rows of cooling holes on the convex airfoil surface are permitted as shown in Figure 202 and as follows:

NOTE: If vanes are found to have cracks which are not in the limits that follow, it will be necessary to remove the vanes for repair.

a Axial and diagonal cracks (no limit to the number) which extend from the cooling holes are permitted.

b A maximum of six adjacent holes in a row of cooling holes are permitted to be connected by a single crack.

c Cracks connecting three or more holes forming a closed loop are not permitted.

Task 72-50-00-210-002:

3. First Stage Turbine Blades Inspection

A. For 1st stage blades that have been subjected to an exhaust gas overtemperature, see Section 72-00-00, Adjustment/Test-01 (Task 72-00-00-760-004), Overtemperature Limits and Procedures.

B. Using a fluorescent (white) light and three to ten power magnification, inspect blades for surface damage and coating defects.

(1) Inspect blades for cracks or warpage. All blades with cracks in the airfoil shall be removed from service.

(2) Blades with nicks or dents limited in depth to 0.010 inch on the leading and trailing edges and 0.005 inch for all other airfoil areas are suitable for continued service provided coating has remained intact.

(3) Loss of coating on blades is not by itself a reason for engine removal. However if sulfidation is serious problem, follow guidelines in Paragraphs C. and D. below.

(4) White material splatter which looks like solder splatter (which is bright, thin, and random in shape or size), that is on the high pressure turbine vanes and blades is magnesium zirconium oxide. Magnesium zirconium oxide on these blades and vanes has no effect on the serviceability or the performance of the item that is splattered, and is therefore acceptable.

(5) Make an inspection of the 1st stage turbine blade shrouds for condition. The limits are as follows:

(a) Engines other than those in (b): no shroud notch areas broken out (single or double) are permitted.

(b) JT8D-1,-1A,-1B,-7,-7A,-7B,-9,-9A pre-SB 5021:

1. Blades with shroud notch material broken out in one place, except those in step (a), are serviceable. See Condition 1 in Figure 203.

2. A blade which has one broken out shroud notch can continue in service if the 1st stage turbine vanes are not badly damaged (bad damage is vane material burned through, or parts of the vane airfoil not there).

   NOTE: If the vanes are badly damaged, see the procedures for vane damage in Paragraph 2. of this section. If the vanes are only moderately damaged, monitor them with the procedures in this section.

3. If the 1st stage turbine vanes show bad damage, and the engine will go to overhaul for vane removal, make a note that removal of the blades which have shroud material broken out will be necessary also.

4. There must be no adjacent blades with shroud notches broken out, or blades with both shroud notches broken out (see Conditions 2, 3, and 4 in Figure 203).

5. There must not be a record that high frequency fatigue caused 1st stage turbine blade failures in the operator's fleet.

6. There must not be more than 12 blades in the rotor which have shroud material broken out.

C. Air-cooled Blade Sulfidation Limits

CAUTION: BLADES WHICH EXHIBIT SULFIDATION WILL DETERIORATE AT A FASTER RATE THAN THEY DID PREVIOUSLY. IT IS RECOMMENDED THAT THESE BE INSPECTED, EITHER BY BORESCOPE OR BY HOT SECTION, WITHIN THE NEXT 2000 HOURS OR 2000 CYCLES, WHICHEVER OCCURS FIRST. SUBSEQUENT INSPECTION INTERVALS SHOULD BE BASED ON INDIVIDUAL OPERATOR EXPERIENCE, DEPENDING ON RATE OF SULFIDATION. ALSO, BLADES WHICH EXHIBIT SULFIDATION AND ARE CONTINUED IN SERVICE WITHOUT REPAIR MAY BE BEYOND REPARABLE LIMITS AT NEXT OVERHAUL.

(1) Sulfidated 1st stage turbine blades may be continued in service provided the following conditions are met:

(a) No more than 25 percent of observable blade concave airfoil surface (including underside of shroud) exhibits sulfidation blistering. Sulfidation spotting (coating degradation as opposed to actual blistering) is acceptable over entire blade.

(b) No blade cooling air holes are broken through to airfoil surface.

NOTE: Current JT8D-15A,-17A,-17AR blades incorporate small holes on either side of leading and trailing edges near shroud. These holes, either open or plugged, are not important for evaluation of sulfidation distress.

(c) Schedule the engine for removal after 250 hours or 200 cycles (when one of these occurs first) if:

1 More than 75 percent of the blade airfoil leading edge has sulfidation or

2 There is leading edge sulfidation which is continuous with wide areas of sulfidation on the concave airfoil surface.

(2) If blades are not acceptable per limits given in step (1), engine must be sent to overhaul for repair compressor drive turbine rotor.

D. Non-air-Sulfidation Limits of Blades that are Not Air-Cooled (JT8D-1,-1A,-1B,-7,-7A,-7B,-9,-9A, and -11 post-SB 5455)

NOTE: Sulfidation of JT8D-7 and JT8D-9 Post-SB 5021 1st stage turbine blades and JT8D-11 Post-SB 5455 1st stage turbine blades starts on the outer surface of the blades or in one or both of the two lightening holes in the airfoil of the blade.

CAUTION: BLADES WHICH EXHIBIT SULFIDATION WILL DETERIORATE AT A FASTER RATE THAN THEY DID PREVIOUSLY. IT IS RECOMMENDED THAT THESE BE

INSPECTED, EITHER BY BORESCOPE OR BY HOT SECTION.

(1) The limits that follow are for 1st stage turbine blades with sulfidation that starts on the outer surface of the blades. First stage turbine blades can continue in service if sulfidation is not more than the limits that follow:

(a) No more than 25 percent of observable blade concave airfoil surface (including underside of shroud) exhibits sulfidation blistering. Sulfidation spotting (coating degradation as opposed to actual blistering) is acceptable over entire blade.

(b) If sulfidation is on less than one half the chord of a blade, examine the blades again after 1000 hours or 1000 cycles (when the first of these occurs).

(c) Blades which have sulfidation damage on the airfoil which is on half the chord or more (from the middle of the blade span out to the shroud) are not satisfactory for continued service. See Figure 204. Schedule these blades for removal in 100 hours or 100 cycles (when the first of these occurs).

(d) Leading edge sulfidation limits are as follows:

1 Leading edge sulfidation which (as a total) is not more than 0.500 inch in length is permitted if the blades are examined after 1000 hours or 1000 cycles (when the first of these occurs). Sulfidation damage on the leading edge must not touch an area of sulfidation damage on the concave airfoil surface.

2 Leading edge sulfidation which (as a total) is not more than 0.750 inch in length is permitted if the blades are examined after 500 hours or 500 cycles (when the first of these occurs). Sulfidation damage on the leading edge must not touch an area of sulfidation damage on the concave airfoil surface.

3 Leading edge sulfidation which is not more than 1.000 inch in length is permitted if the blades are examined after 250 hours or 250 cycles (when the first of these occurs). Sulfidation damage on the leading edge must not touch an area of sulfidation damage on the concave airfoil surface.

4 Leading edge sulfidation which is more than 1.000 inch in length is not permitted. Remove blades with this damage in no more than 100 hours or 100 cycles (when the first of these occurs).

(2) The limits that follow are for 1st stage turbine blades with sulfidation that starts in one or both of the lightening holes in the airfoil of the blade. First stage turbine blades can continue in service if the radial crack or blister dimensions are not more than the limits that follow:

NOTE: Sulfidation which starts in the lightening holes is shown as a radial crack or blister on the concave or convex surface of the airfoil in less than 1.250 inch of the shroud.

NOTE: Make sure that no blade internal slots are broken through to airfoil surface.

(a) One radial crack or blister 0.500 inch maximum length is permitted on each blade. Examine the cracked or blistered blades in 400 hours or 400 cycles. Remove blades with crack or blister dimensions more than the limits given in step (b).

NOTE: Use the 400 hour limit if it is expired before the 400 cycle limit.

(b) One radial crack or blister with a length of 0.500 inch to less than 0.750 inch is permitted on each blade. Examine cracked or blistered blades in 130 - 140 hours or cycles for an increase in crack length. Remove the engine in 50 hours maximum if radial cracks or blisters continue into axial cracks or if the radial crack length is 0.750 inch or more.

NOTE: Use the 130 - 140 hour limit if it is expired before the 130 - 140 cycle limit.

E. First Stage Turbine Blade Rivet Inspection
(JT8D-15A,-17,-17A,-17R and -17AR)

(1) Inspect 1st stage turbine blades for broken rivets and missing washers. Damage is visible on front face of turbine disk.

F. First Stage Turbine Blade Metering Plate Inspection
(JT8D-15A,-17A)

(1) Inspect 1st stage turbine blades for missing (liberated) metering plates. Metering plates are located on trailing edge of blade root. Rotors containing up to twelve blades with missing (liberated) metering plates are suitable for continued service.

(2) If blades are not acceptable per limits given in step (1), engine must be sent to overhaul for repair of rear compressor drive turbine rotor.

Task 72-50-00-300-001:

4. First Stage Turbine Blades Repair

A. Blades with nicks or dents within airfoil area are not to be reworked.

Task 72-50-00-210-003:

5. Second Stage Turbine Blades and Vanes Inspection

A. Visually inspect 2nd stage turbine vanes for loss or melting of coating, leading or trailing edge cracks, and bending or tilt.

B. Visually inspect 2nd stage turbine blades for leading or trailing edge cracks and/or melting.

NOTE: If visual inspection shows any signs of deterioration, remove the engine, remove and disassemble front compressor drive turbine rotor, and perform an overhaul type inspection.

Task 72-50-00-210-004:

6. Third and 4th Stage Turbine Blade Inspection

A. Visual inspection

(1) Examine all 4th stage turbine blades for nicks, dents, and cracks.

B. Blade shroud tightness inspection

(1) Do a shroud looseness check of 3rd and 4th stage turbine blades. Refer to Maintenance Advisory Note MAN-JT8D-1-06 for procedures, limits, and the effects of shroud looseness on engine serviceability.

Task 72-50-00-420-001:

7. Removal/Installation of No. 6 Bearing Oil Scavenge Pump

See Figures 205 and 206.

A. Removal

NOTE: In following procedure No. 6 bearing inner internal pressure tube assembly cannot be removed from exhaust case and duct assembly unless fan exhaust outer duct has been modified to incorporate access cover at 12 o'clock position. On other assemblies, tube may only be moved upward to allow removal and installation of No. 6 bearing oil scavenge pump.

(1) Loosen and remove bolts and washers securing upper and lower fan exhaust inner front duct segments to turbine exhaust case. Remove ducts.

NOTE: On JT8D-17R and -17AR engines, ensure that turbine case shield (retained around turbine nozzle case by inner front duct bolts) does not shift by installing several workbolts in front boltholes while removing duct halves.

(2) Disconnect outer internal pressure oil tube at 12 o'clock position on turbine exhaust case.

(3) Loosen and remove the bolts securing internal oil pressure tube to turbine exhaust case.

(a) For engines having non-separable pin (boss) and oil tube assemblies, loosen and remove bolts securing tube boss to turbine exhaust case. See Figure 205.

(b) For engines having separable pin and oil tube assemblies, (see Figure 205) either unbolt tube pin and remove pin with tube assembly, or leave pin in place and remove tube through pin after following steps are completed.

(c) For engines having bracket securing tube elbow to exhaust case rail, unbolt bracket from tube elbow and rotate tube elbow lug away from bracket to allow tube to be moved outward. Remove tube as directed in (b).

(4) Loosen and remove bolts securing No. 6 bearing heatshield to No. 6 bearing support. Remove heatshield and No. 6 bearing cover.

(5) Bend tabs of key washer free of No. 6 bearing support and loosen nut securing internal oil pressure tube to support. Lift tube from pump and remove nut and washer.

(6) Cut the lockwire from the No. 6 bearing pressure tube bolts and loosen the bolts so that the tube can move.

(7) Loosen and remove bolts (and washers, if present) securing pump legs to rear face of No. 6 bearing housing. See Figure 206.

NOTE: A pump Post-SB 6131 will have bushings under the heads of the bolts that hold the pump to the No. 6 bearing housing. Remove these bushings with the bolts.

(8) Remove bolts and key washers securing scavenge pump spur gearshaft to turbine shaft. Rotate low compressor to reach bolts obscured by pump.

NOTE: For engines not incorporating SB 1016, No. 6 bearing oil scavenge pump may be removed without removing scavenge pump drive spur gearshaft.

(a) Remove the pump and tube (with the gearshaft from the end of the turbine shaft).

(9) Remove the bolts which attach the No. 6 bearing pressure tube to the pump housing. Remove the tube from the housing.

B. Installation

(1) If the engine has an oil damped No. 6 bearing, assemble the No. 6 bearing pressure tube and pump as follows:

CAUTION: IF YOU APPLY PETROLATUM TO THE PRESSURE TUBE PACKING, USE ONLY A SMALL QUANTITY ON THE PACKING TO PREVENT POSSIBLE CONTAMINATION OF THE OIL SYSTEM.

(a) Install a new packing (lubricated with a thin layer of PWA 36500 Assembly Fluid or petrolatum) in the groove of the No. 6 bearing pressure tube.

(b) Install the tube on the No. 6 bearing scavenge pump and attach the tube loosely with two bolts (the tube must move).

NOTE: It is optional to use petrolatum as a replacement for PWA 36500 Assembly Fluid. But it is better to use the assembly fluid. Use petrolatum only if assembly fluid becomes unavailable.

(2) Install the scavenge pump assembly (with the gearshaft) in the bearing compartment. Holes in the pump bracket align with dowel pins in the No. 6 bearing retaining plate. Make sure that the No. 6 bearing pressure tube (oil-damped bearing type) goes easily into the boss on the retaining plate. Install and torque the three pump bolts (with washers as necessary). Safety the bolts with lockwire.

NOTE: Pump assemblies Pre-SB 3845 have washers under the heads of the bolts that attach the pump to the bearing housing. A pump Post-SB 6131 will have bushings under these bolt heads. Be sure to install these bushings in the recesses of the pump bracket before the bolts are installed. See Figure 205.

NOTE: If a pump is Pre-SB 3845 and Post-SB 6131, do not install washers with the bushings.

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(3) Torque the No. 6 bearing pressure tube bolts (oil-damped bearing area) and safety them with lockwire.

CAUTION: WITH PN 491204 HUB, ONLY PN 101109 BOLT SHALL BE USED. TORQUE FOR THESE BOLTS IS 75 - 85 LB-IN.

(a) Position spur gearshaft in ID of turbine hub and install bolts, with key washers. Turn rotor as necessary to make bolt holes in hub accessible. Torque bolts 95 - 105 pound-inches and secure with key washers.

NOTE: "X" mark on outer face of certain spur gearshafts need not be aligned with any other feature of rotor.

(4) If oil tube assembly and tube pin (or boss) were removed from engine, treat inner and outer surfaces of No. 6 bearing oil tube pin (or oil tube boss) with
R thin coat of Anti-seize Paste (PWA 36246) and remove
R unwanted paste. Apply same treatment to outer surfaces of inner internal pressure tube assembly which will contact pin (or boss). Do not bake coating on these parts.

NOTE: Current-type inner internal tube assembly is separable from "tube pin" which anchors turbine exhaust duct and fairing assembly at 12 o'clock position, and tube may be installed or removed through pin without removing pin from exhaust case, if desired. Former tube assemblies have pin or "tube boss" as part of assembly, and tube and boss must be installed together. See Figure 205.

(5) Install No. 6 bearing oil tube assembly in exhaust case and No. 6 bearing housing. See Figure 205.

CAUTION: MAKE CERTAIN THAT ANTI-ROTATION LUG ON OIL TUBE IS PROPERLY POSITIONED IN NOTCH ON NO. 6 BEARING HOUSING.

(a) For engine having non-separable pin and oil tube assemblies, arrange boss on tube assembly at upper end (near elbow) and install new gasket on inner end against shoulder of inner connector. Install tube assembly into exhaust case through fairing

12 o'clock strut, and as tube enters bearing housing install key washer and locknut on threaded connector. Insert tube in pump receptacle and engage locating lug on inner connector with notch on bearing housing. Torque locknut to 135 - 150 pound-inches and secure with key washer.

CAUTION: SEPARABLE TYPE OIL TUBE ASSEMBLY HAS LOWER CONNECTOR WITH CONICAL SURFACE TO MATE WITH CONICAL SEAT ON BEARING HOUSING WALL. ON TUBE ASSEMBLY HAVING POSITIONING LUG ON ELBOW MATING WITH TUBE PIN, ENSURE THAT LUG IS PROPERLY POSITIONED IN NOTCH OF PIN.

(b) For engines having separable pin and oil tube assemblies, either install pin assembly in exhaust case or slide pin assembly onto tube and install with tube, as required. Install tube assembly into exhaust case through fairing 12 o'clock strut, and as tube enters bearing housing, install key washer and locknut on threaded connector. Insert tube in pump receptacle. If tube assembly has positioning lug on elbow, engage lug in notch on pin; if tube is positioned by bracket from elbow to exhaust case rail, bolt elbow to bracket (lockwire bolthead to elbow lug). Torque locknut to 280 - 320 pound-inches and secure with key washer.

(6) Bolt tube pin (or boss) in place at outside of exhaust case and lockwire bolts to each other after torquing.

(7) Connect No. 6 bearing pressure tube to outer internal pressure tube. Torque connection and lockwire.

NOTE: If outer internal pressure tube is SB 5465 type, apply torque of 135 - 150 pound-inches to connection.

(8) Place new chevron gasket in rear flange of bearing support and install No. 6 bearing cover to seat.

(9) Install No. 6 bearing heatshield and secure with bolts and lockwire.

C. No. 6 Bearing Pressure Tube Repair With Fan Exhaust Case Installed
See Figure 207.

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R

(1) Machine as necessary to remove bottom portion of detail tube as shown.

(2) Remove sharp edges.

(3) Measure ID of tube and record.

(4) Select tube (PN 531528) of appropriate class (see Table 201) to obtain desired 0.001T - 0.001L inch fit at Diameter A.

(5) Install new tube and scavenge pump housing. See Paragraph B.

Task 72-50-00-440-001:

8. Disassembly/Assembly of No. 6 Bearing Oil Scavenge Pump

See Figure 208.

A. Disassembly

(1) Loosen and remove bolts, washers, and nuts securing cover and shield to pump. Remove shield and remove cover.

(2) Remove idler gear from pump.

(3) Loosen and remove nut and washer from gearshaft.

(4) Position PWA 12041 Puller on gear and remove gear.

(5) Remove oil pump gearshaft.

(6) Remove bushing and filter from pressure oil internal tube passage of pump.

(7) Remove bolt and washer (or bolt and nut, if nozzle has two-hole flange) securing No. 4 1/2 bearing oil nozzle assembly to pump. Remove nozzle assembly.

Part No.		Dia. A Dim.
531528CL1	over	0.221 to 0.222
531528CL2	over	0.222 to 0.223
531528CL3	over	0.223 to 0.224
531528CL4	over	0.224 to 0.225
531528CL5	over	0.225 to 0.226
531528CL6	over	0.226 to 0.227
531528CL7	over	0.227 to 0.228

R
R Tube Classification Data
Table 201

Part No.		Dia. A Dim.
(CONTINUED)		
531528CL8	over	0.228 to 0.229
531528CL9	over	0.229 to 0.230
531528CL10	over	0.230 to 0.231
531528CL11	over	0.231 to 0.232
531528CL12	over	0.232 to 0.233
531528CL13	over	0.233 to 0.234
531528CL14	over	0.234 to 0.235
531528CL15	over	0.235 to 0.236
531528CL16	over	0.236 to 0.237
531528CL17	over	0.237 to 0.238

Tube Classification Data
Table 201 (Continued)

(8) If pump housing and mounting bracket are separable type (see figure), remove housing from bracket.

B. Assembly

(1) If pump housing and mounting bracket are separable type (see figure), assemble housing and bracket, using locating pin in pump housing to establish position of bracket.

(2) Position gearshaft in pump.

(3) Position oil pump gear on gearshaft.

(4) Install key washer and nut on gearshaft.

(5) Tighten nut to 150 - 300 pound-inches, then bend tabs of key washer.

(6) Position idler gear in pump.

(7) Position cover on pump with idler shaft through idler gear.

(8) Position shield on pump and install bolts through cover, pump, and shield bracket.

(9) For pump having No. 4 1/2 bearing oil nozzle assembly with two hole mount flange, secure nozzle lower flange to pump using cover bolt. Secure upper flange with bolt and washer, torque and lockwire.

(10) Install washers and nuts on pump cover bolts and torque and lockwire.

(11) Position filter, washer, and bushing in pressure oil internal tube passage of pump. Tighten and lockwire.

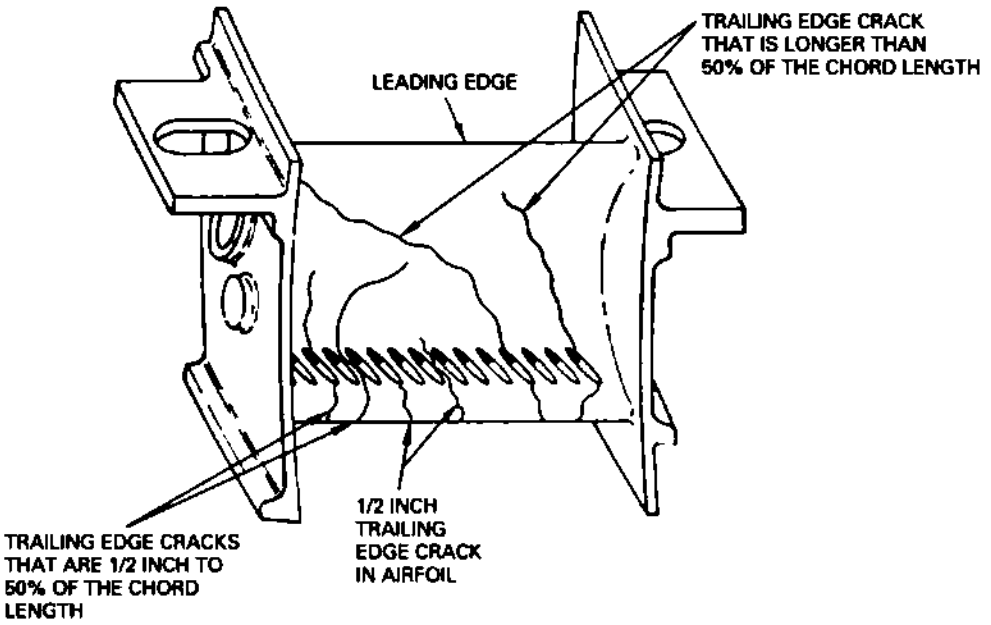
(12) Secure No. 4 1/2 bearing oil nozzle assembly (having single hole in mount-flange) with washer and bolt. Tighten bolt and lockwire.

Task 72-50-00-990-002:

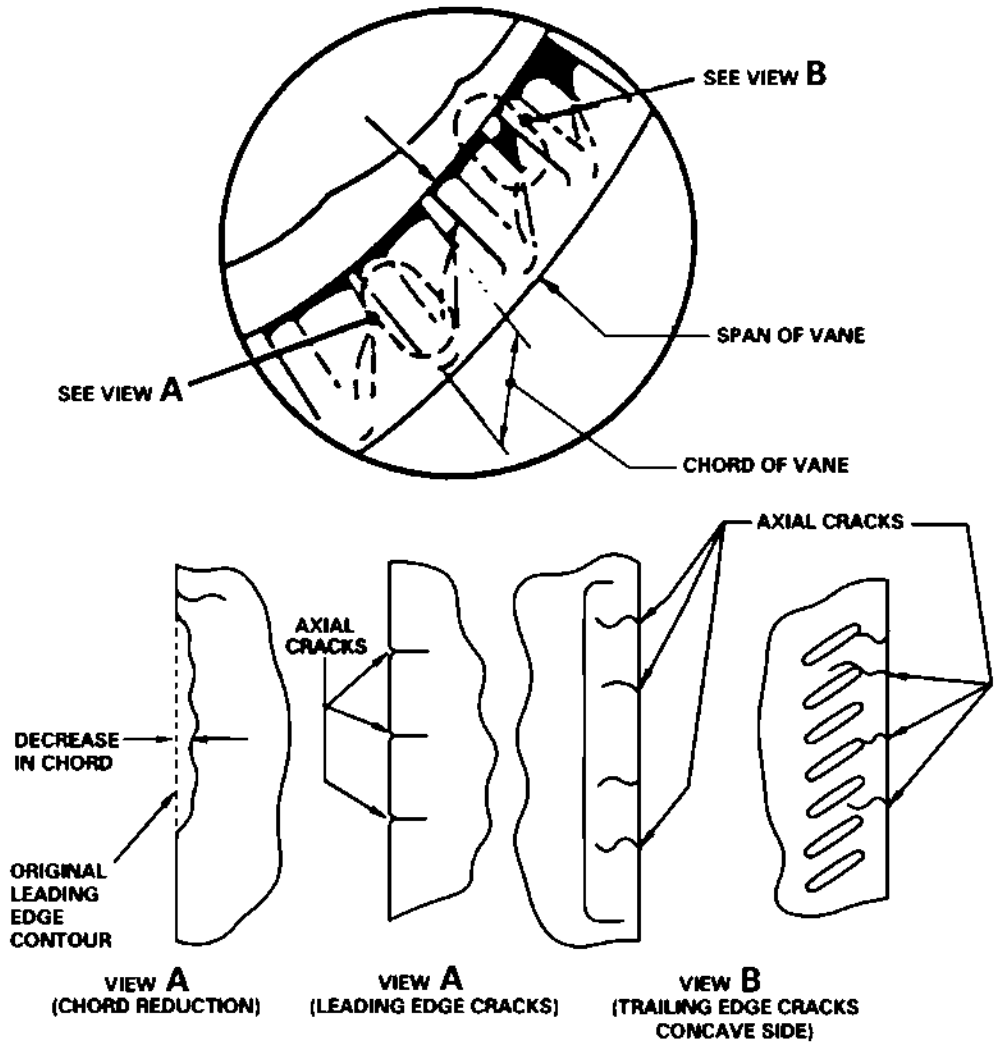
9. Special Tools

A. Tools

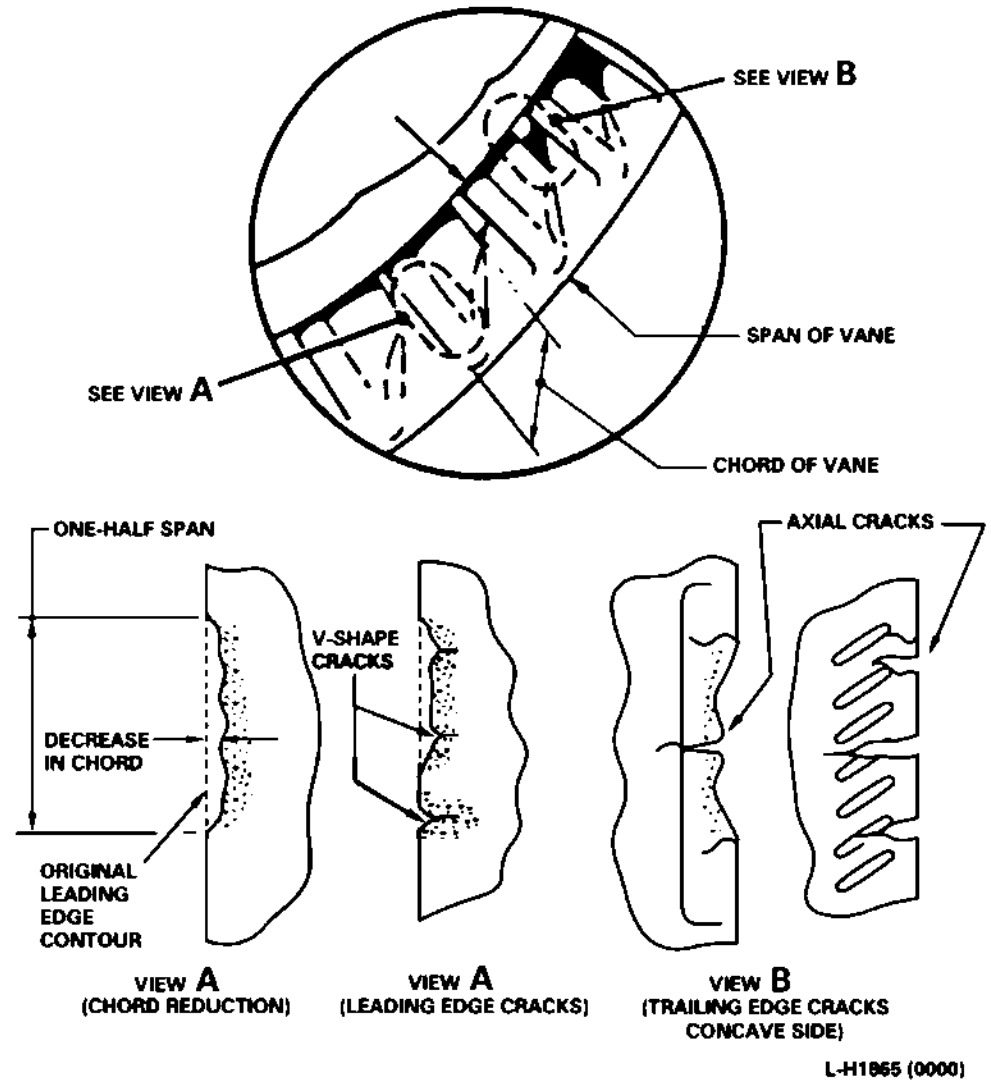
PWA 12041 Puller - No. 6 Bearing Oil Pump Gear



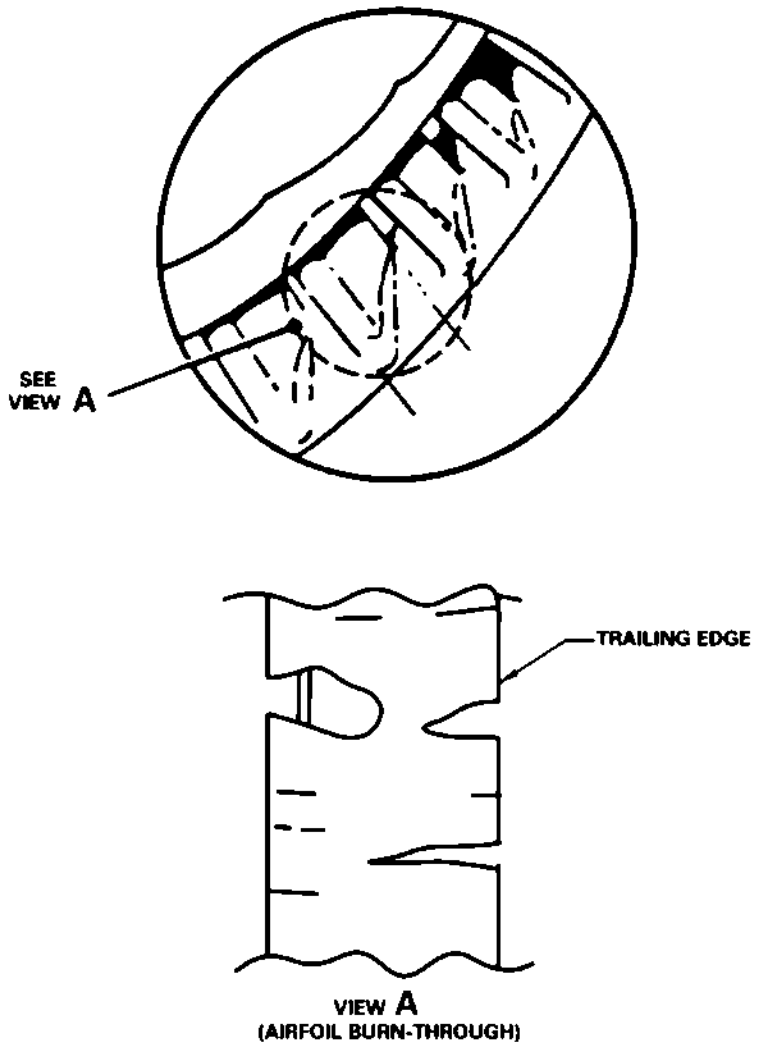
First Stage Turbine
Vane Crack Limits
Figure 201 (Sheet 1)
(Task 72-50-00-990-002)



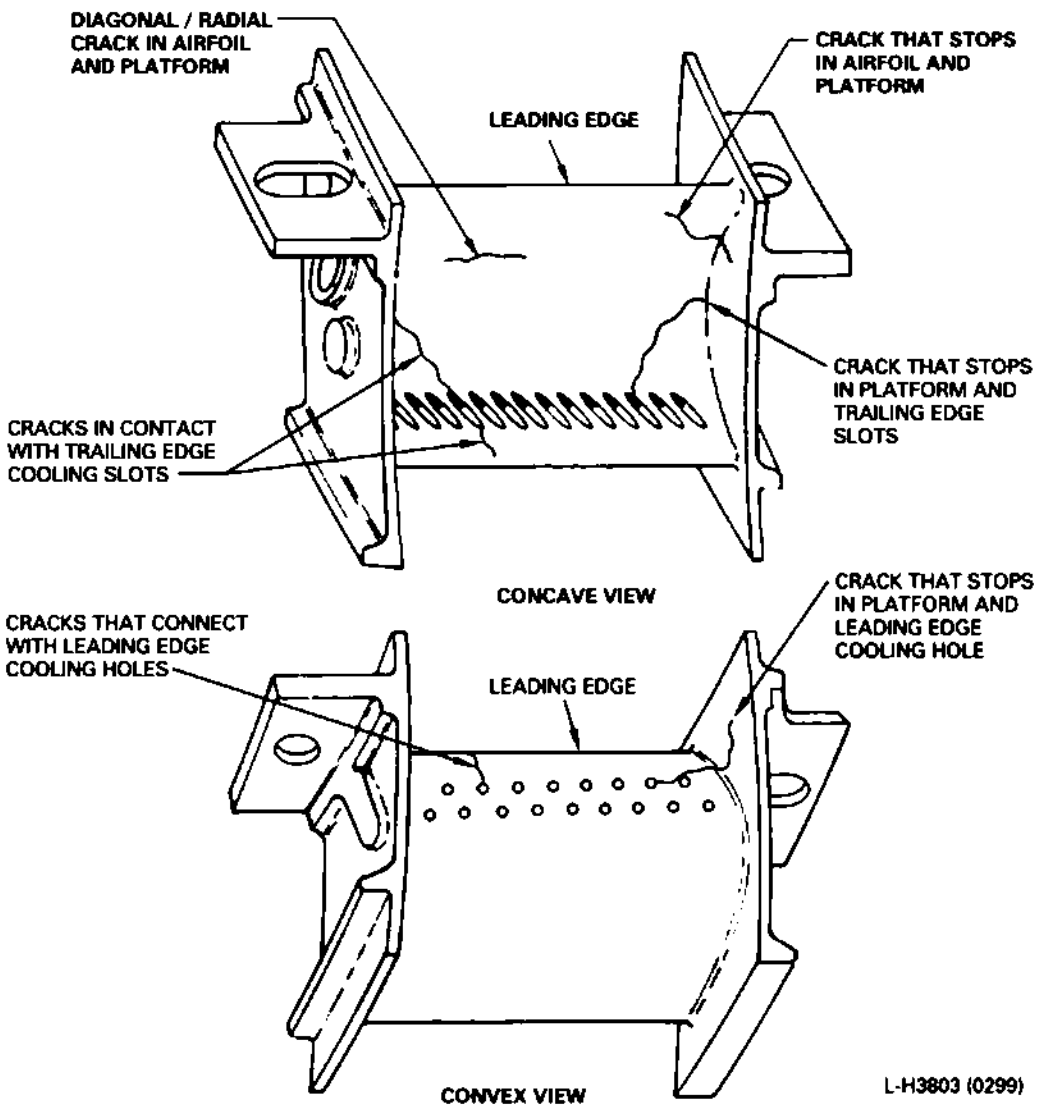
First Stage Turbine
Vane Crack Limits
Figure 201 (Sheet 2)
(Task 72-50-00-990-002)



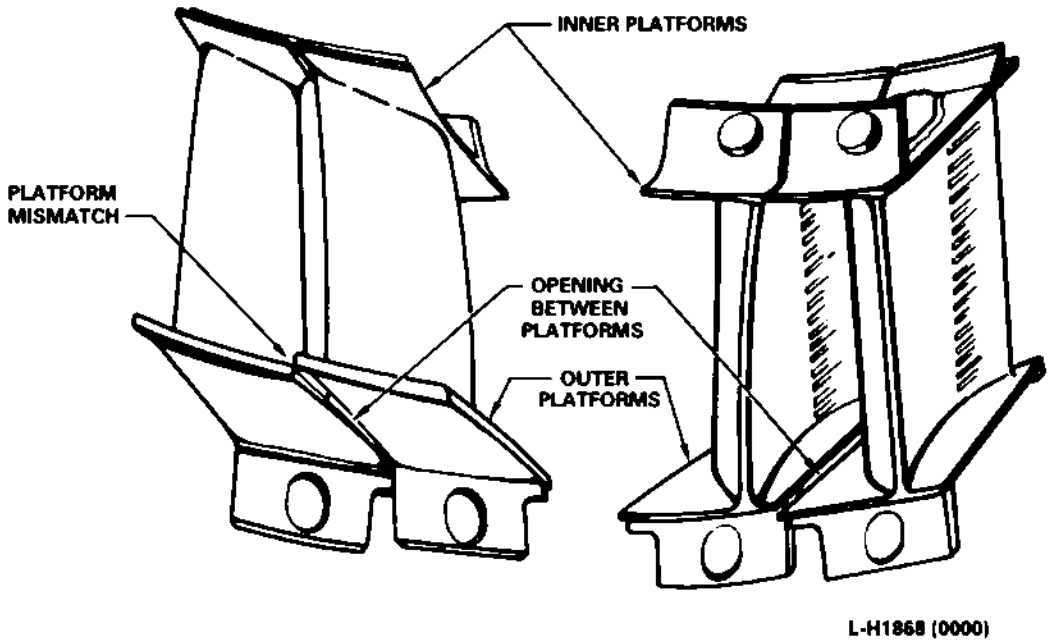
First Stage Turbine
Vane Crack Limits
Figure 201 (Sheet 3)
(Task 72-50-00-990-002)



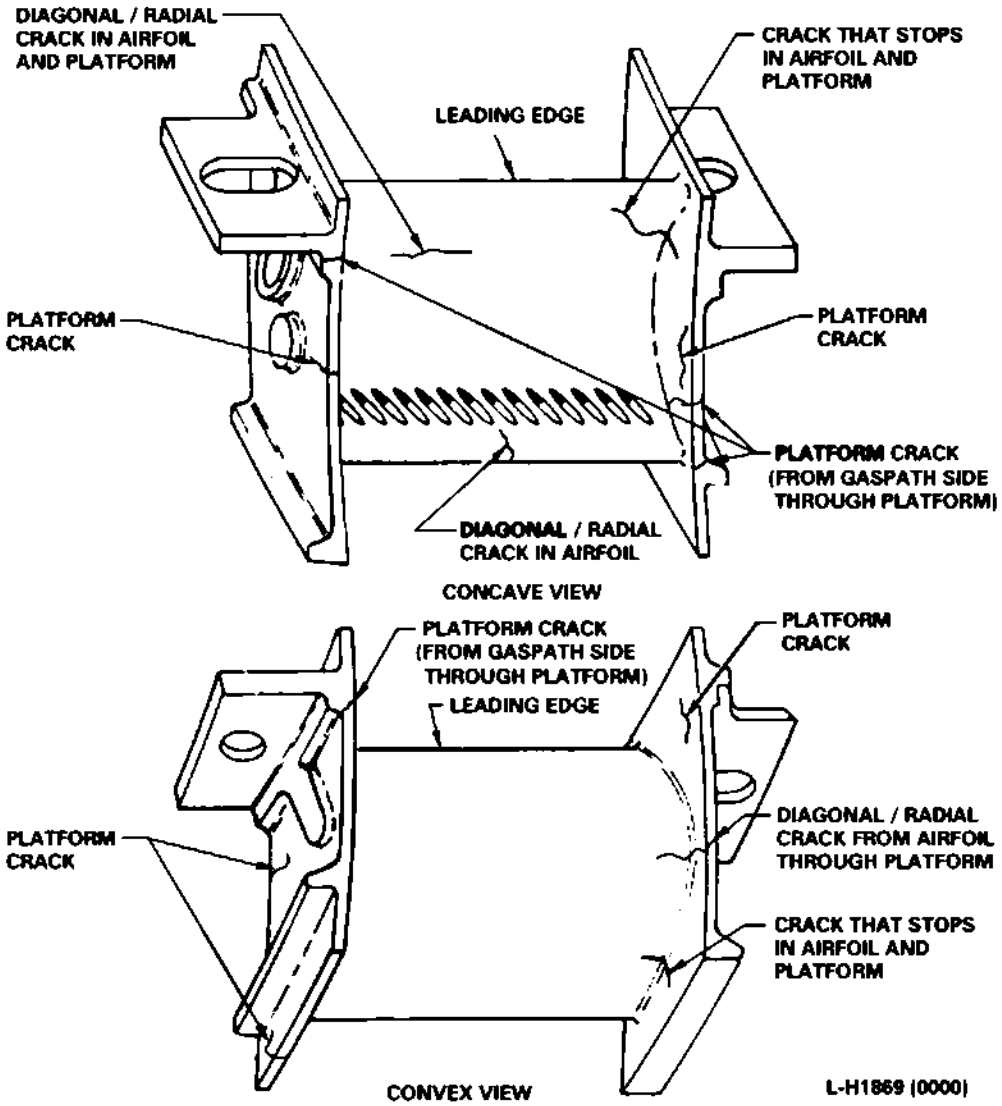
First Stage Turbine
Vane Crack Limits
Figure 201 (Sheet 4)
(Task 72-50-00-990-002)


DIAGONAL / RADIAL CRACK IN AIRFOIL AND PLATFORM
CRACK THAT STOPS IN AIRFOIL AND PLATFORM
LEADING EDGE
CRACK THAT STOPS IN PLATFORM AND TRAILING EDGE SLOTS
CRACKS IN CONTACT WITH TRAILING EDGE COOLING SLOTS
CONCAVE VIEW
CRACK THAT STOPS IN PLATFORM AND LEADING EDGE COOLING HOLE
CRACKS THAT CONNECT WITH LEADING EDGE COOLING HOLES
LEADING EDGE
CONVEX VIEW
L-H3803 (0299)

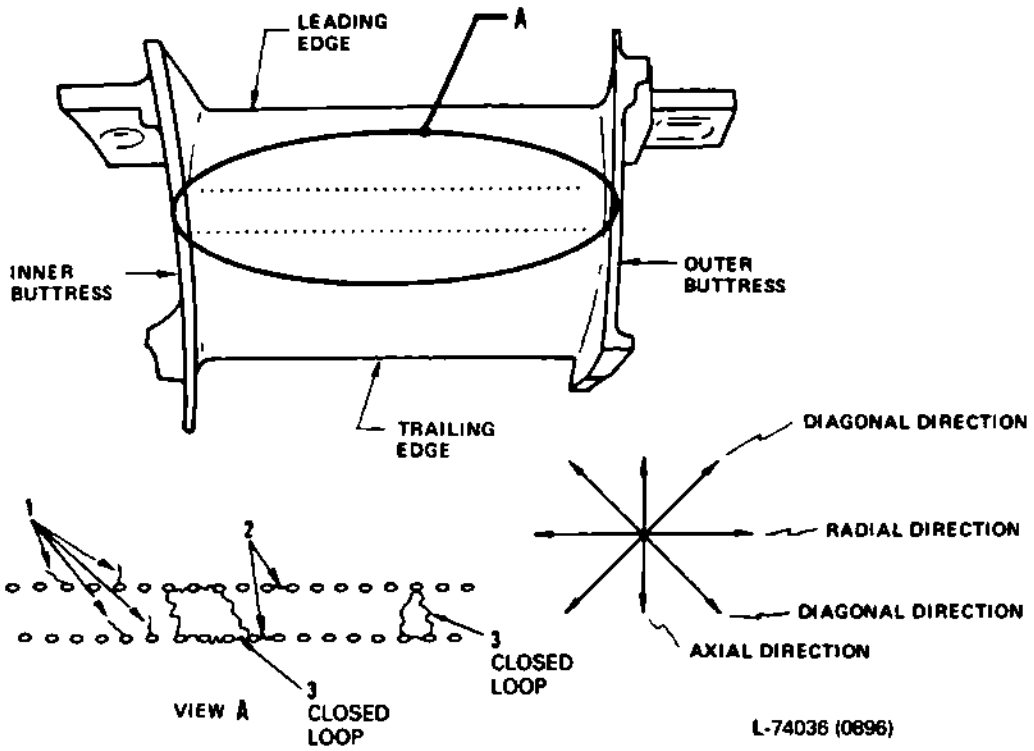
First Stage Turbine
Vane Crack Limits
Figure 201 (Sheet 5)
(Task 72-50-00-990-002)



First Stage Turbine
Vane Crack Limits
Figure 201 (Sheet 6)
(Task 72-50-00-990-002)

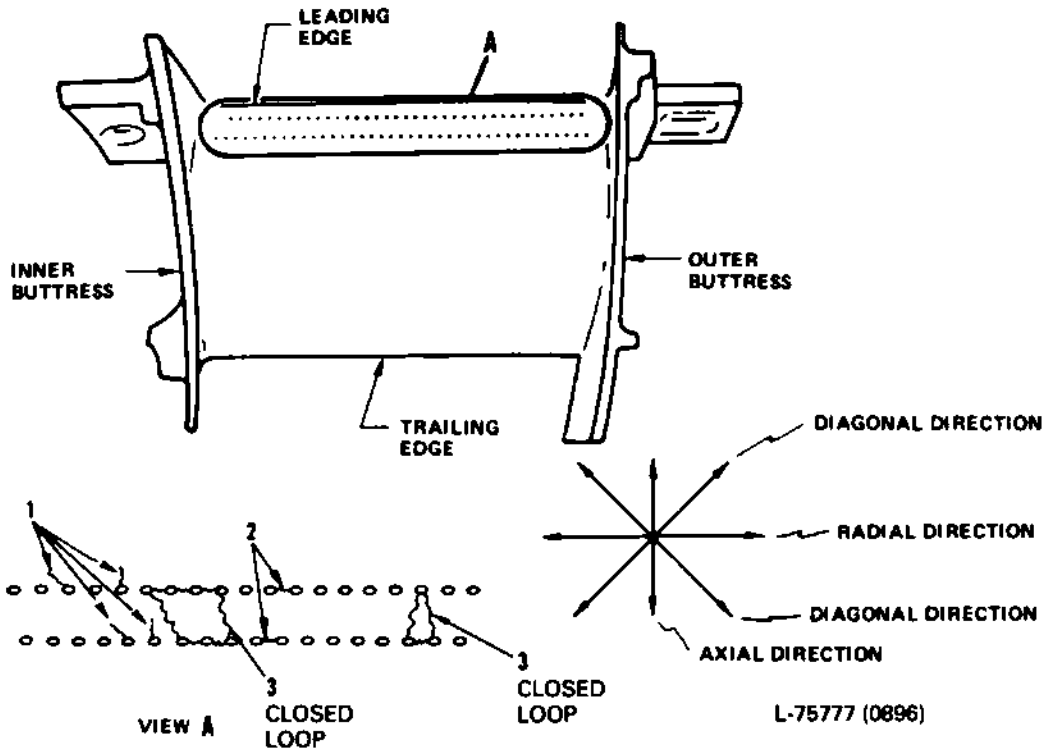

DIAGONAL / RADIAL CRACK IN AIRFOIL AND PLATFORM
CRACK THAT STOPS IN AIRFOIL AND PLATFORM
LEADING EDGE
PLATFORM CRACK
PLATFORM CRACK
PLATFORM CRACK (FROM GASPATH SIDE THROUGH PLATFORM)
DIAGONAL / RADIAL CRACK IN AIRFOIL
CONCAVE VIEW
PLATFORM CRACK (FROM GASPATH SIDE THROUGH PLATFORM)
PLATFORM CRACK
LEADING EDGE
PLATFORM CRACK
DIAGONAL / RADIAL CRACK FROM AIRFOIL THROUGH PLATFORM
CRACK THAT STOPS IN AIRFOIL AND PLATFORM
CONVEX VIEW
L-H1869 (0000)

First Stage Turbine
Vane Crack Limits
Figure 201 (Sheet 7)
(Task 72-50-00-990-002)



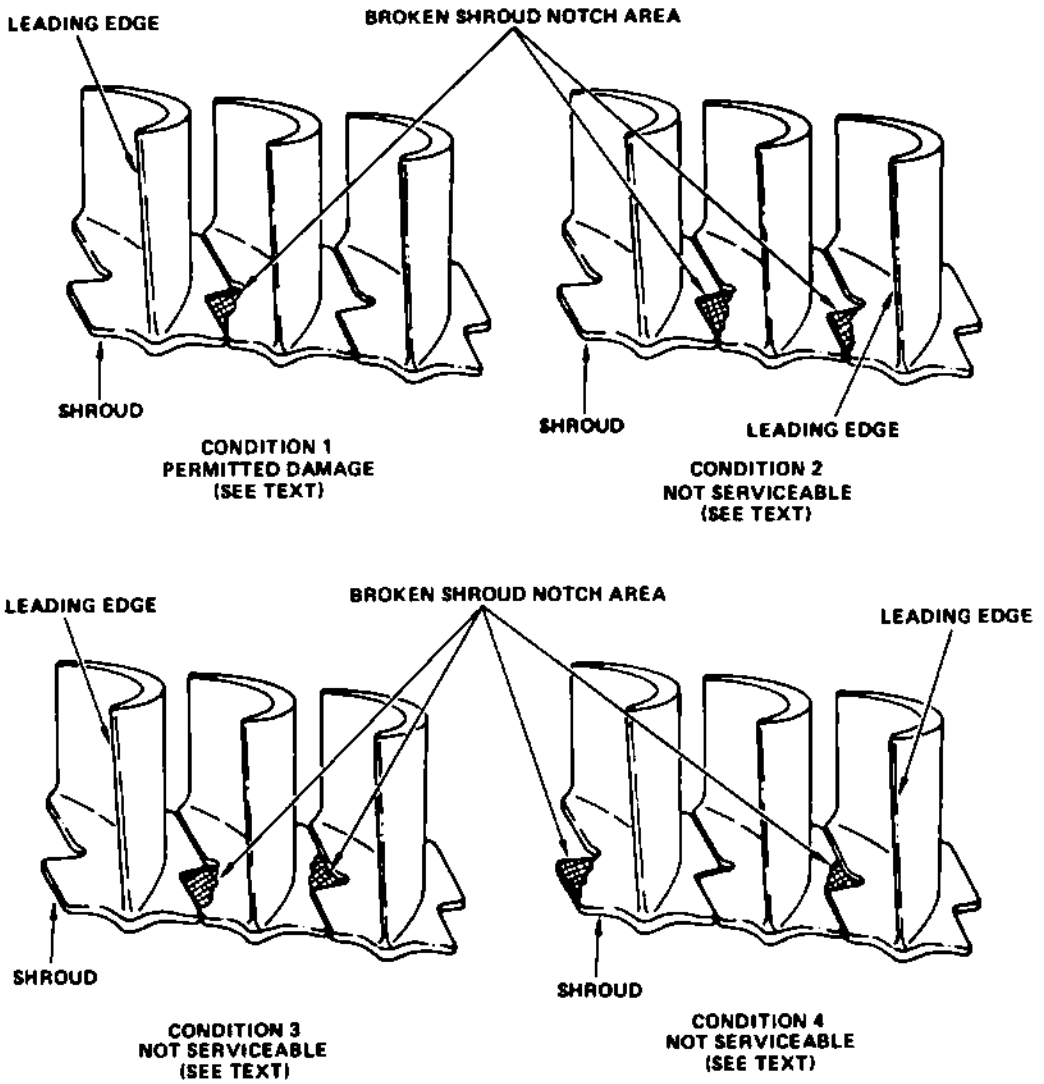
1. Typical Axial And Diagonal Cracks Originating Out Of Cooling Holes, No Limit On Number Of Cracks.
2. Typical Radial Cracks Connecting Cooling Holes, Maximum Of Six Adjacent Holes Per Row Can Be Connected By A Single Crack.
3. Cracks Connecting Three Or More Holes Forming Closed Loop Not Permitted.

Convex Airfoil Cooling
Hole Crack Limits
Figure 202 (Sheet 1)
(Task 72-50-00-990-002)

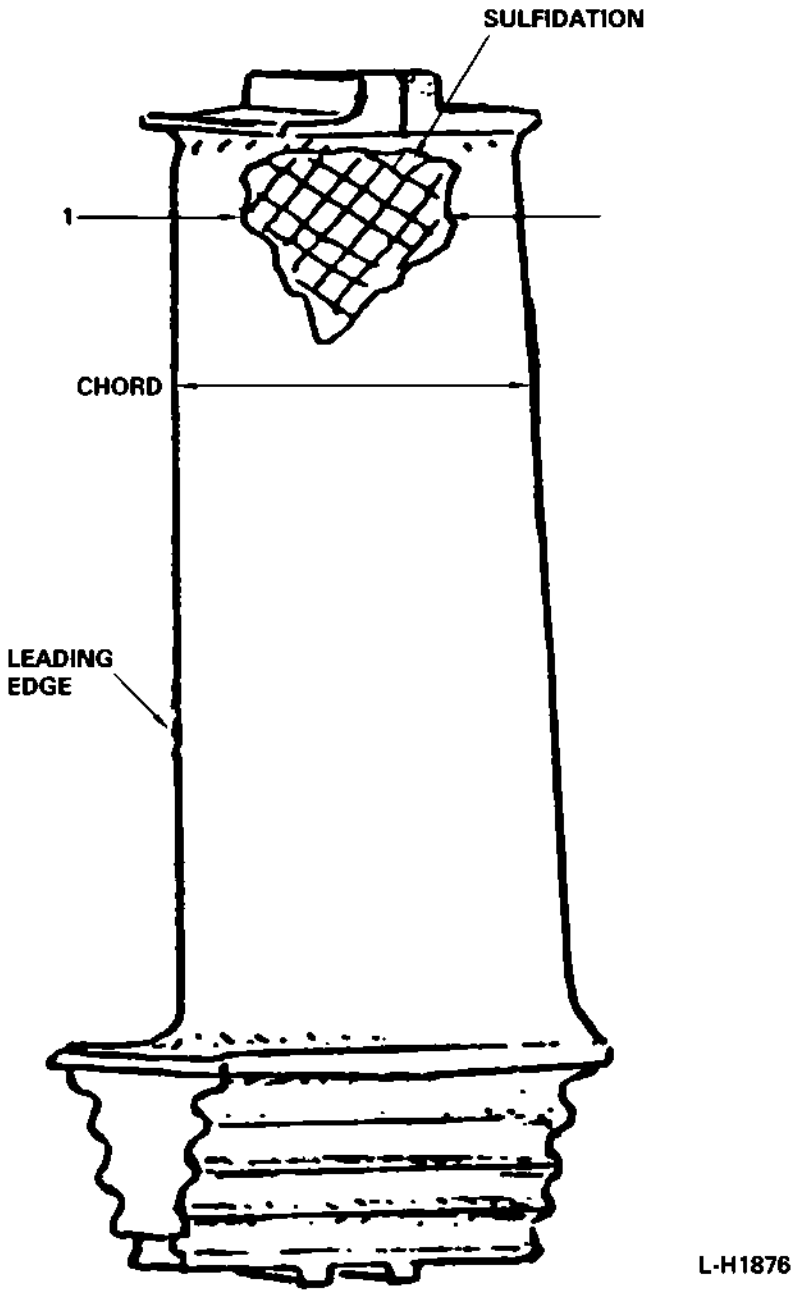


1. Typical Axial And Diagonal Cracks Originating Out Of Cooling Holes, No Limit On Number Of Cracks.
2. Typical Radial Cracks Connecting Cooling Holes, Maximum Of Six Adjacent Holes Per Row Can Be Connected By A Single Crack.
3. Cracks Connecting Three Or More Holes Forming Closed Loop Not Permitted.

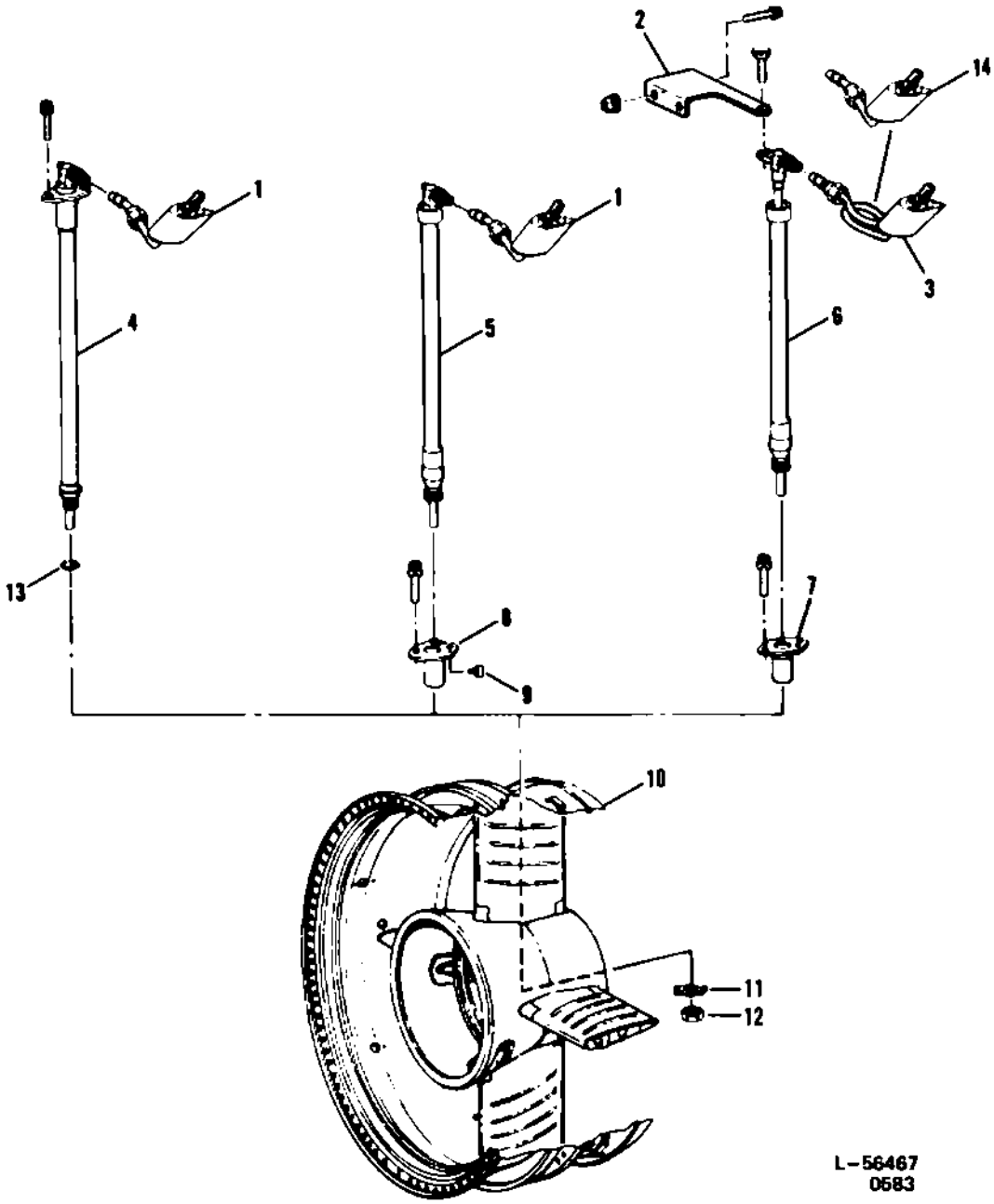
Crack Limits For First Stage
Turbine Vanes Incorporating
Convex Airfoil Cooling Holes
Figure 202 (Sheet 2)
(Task 72-50-00-990-002)



Broken Shroud Notch Limits
(JT8D-1,-1A,-1B,-7,-7A,-7B,-9,
-9A Pre SB 5021)
Figure 203
(Task 72-50-00-990-002)



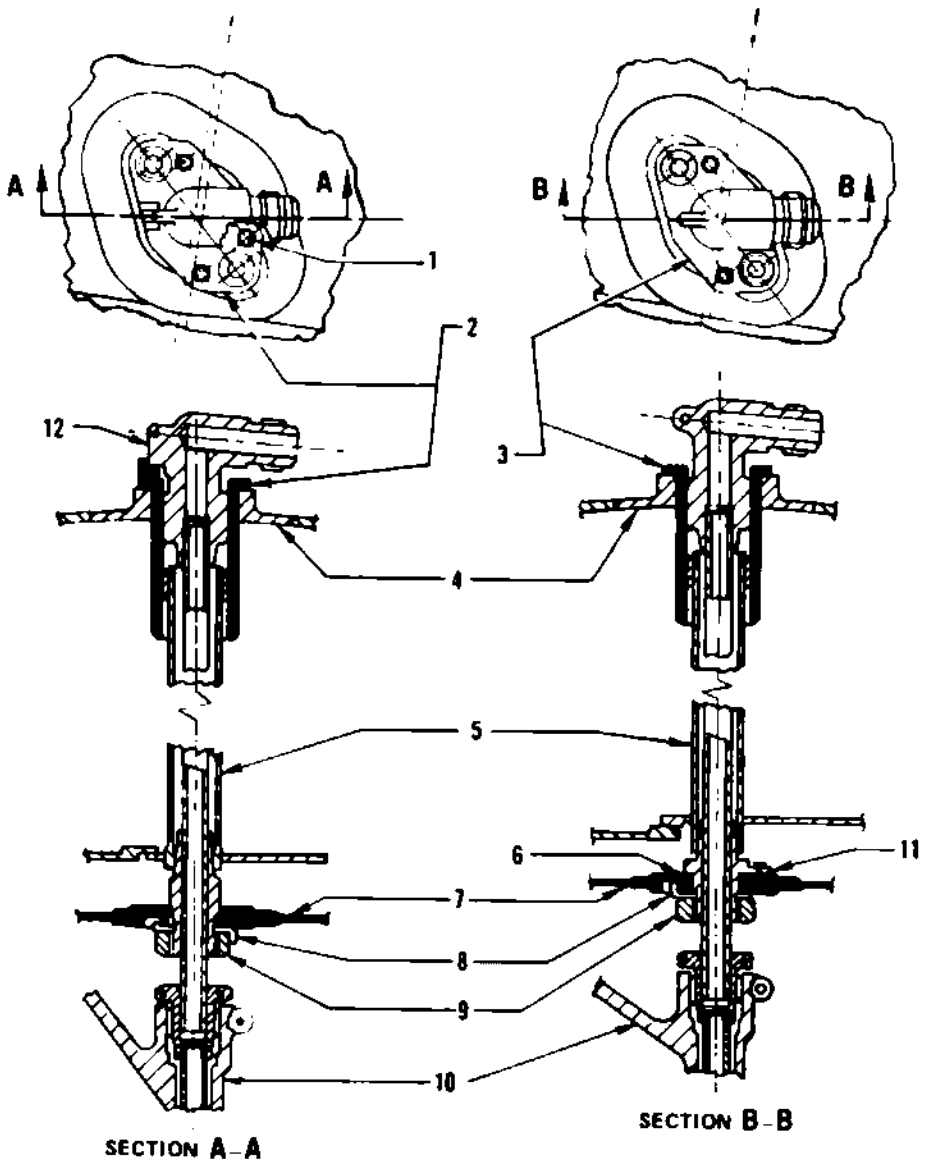
See Text Sulfidation Limits
(JT8D-1,-1A,-1B,-7,-7A,-7B,-9,-9A
Post-SB 5021 and
JT8D-11 Post-SB 5455)
Figure 204
(Task 72-50-00-990-002)



No. 6 Bearing Oil Tube Assembly
Figure 205 (Sheet 1)
(Task 72-50-00-990-002)

1. No. 6 Bearing Outer Internal Pressure Tube
2. No. 6 Bearing Pressure Tube Bracket
3. No. 6 Bearing Outer Internal Pressure Tube (Prior To SB 5465) (Use With Index 6 Tube)
4. No. 6 Bearing Inner Internal Pressure Tube (Non-Separable Tube And Boss Type)
5. No. 6 Bearing Inner Internal Pressure Tube (Separable Tube And Pin Type, Pin-Supported)
6. No. 6 Bearing Inner Internal Pressure Tube (Separable Tube And Guide Type, Bracket Supported)
7. Guide
8. Pin
9. Positioning Pin (Used With PN 636545 Or 702556 Pin Only)
10. Exhaust Case And Fairing Assembly
11. Key Washer
12. Nut
13. Gasket
14. No. 6 Bearing Outer Internal Pressure Tube (Incorporating SB 5465) (Use With Index 6 Tube)

Key to Figure 205 (Sheet 1)



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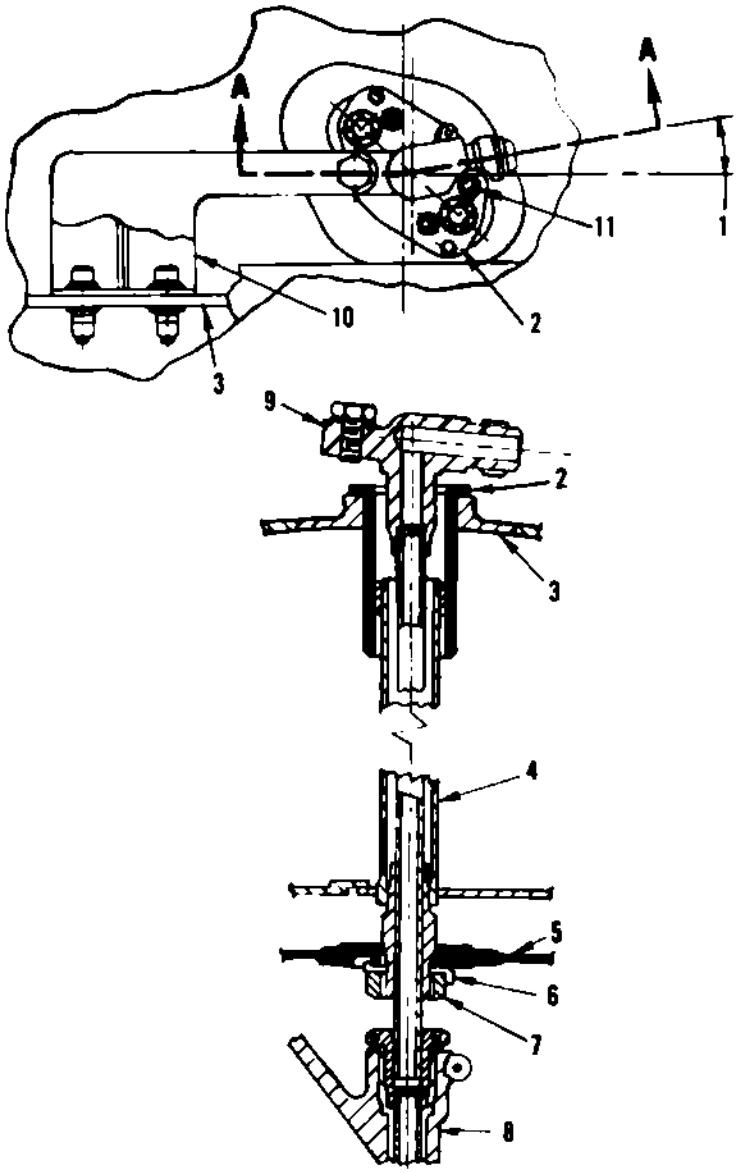
PIN SUPPORTED TUBE ASSEMBLIES

No. 6 Bearing Oil Tube Assembly
Figure 205 (Sheet 2)
(Task 72-50-00-990-002)

1. Anti-rotation Pin
2. Pin Assembly
3. Tube Boss
4. Turbine Exhaust Case
5. Oil Tube Assembly
6. Gasket
7. No. 6 Bearing Housing
8. Key Washer
9. Oil Tube Nut
10. Oil Pump Housing
11. Oil Tube Positioning (Anti-Rotation) Lug (For Tube Assembly Having Non-Separable Pin Assembly).
12. Oil Tube Positioning (Anti-Rotation) Lug (For Tube Assembly Having Separable Pin Assembly).

Key to Figure 205 (Sheet 2)



SECTION A-A

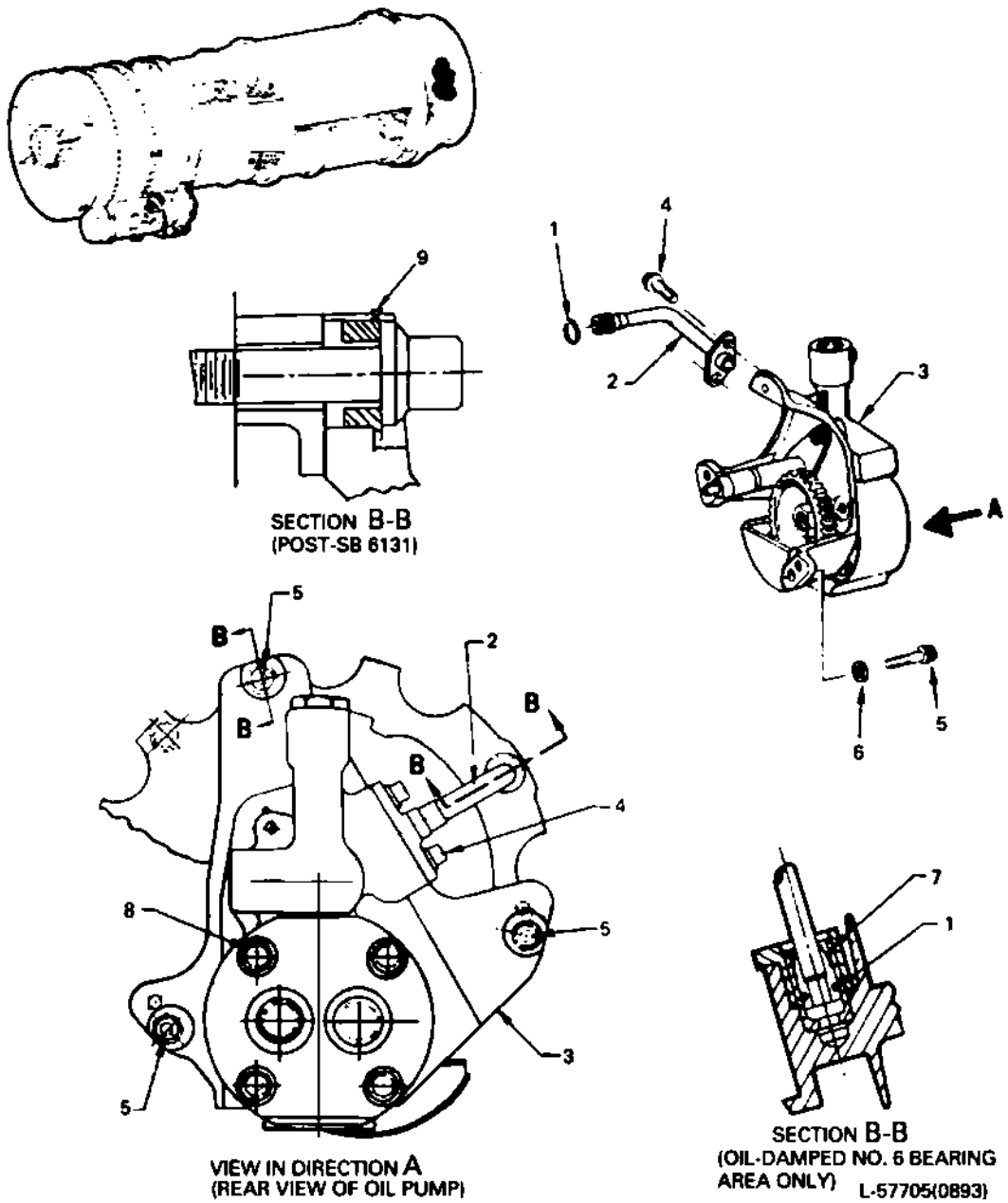
BRACKET SUPPORTED TUBE ASSEMBLY

L-56468
1-77

No. 6 Bearing Oil Tube Assembly
Figure 205 (Sheet 3)
(Task 72-50-00-990-002)

1. 9° ± 1°
2. Guide
3. Turbine Exhaust Case
4. Oil Tube Assembly
5. No. 6 Bearing Housing
6. Key Washer
7. Oil Tube Nut
8. Oil Pump Housing
9. Tube Elbow
10. Bracket
11. Locating Pin

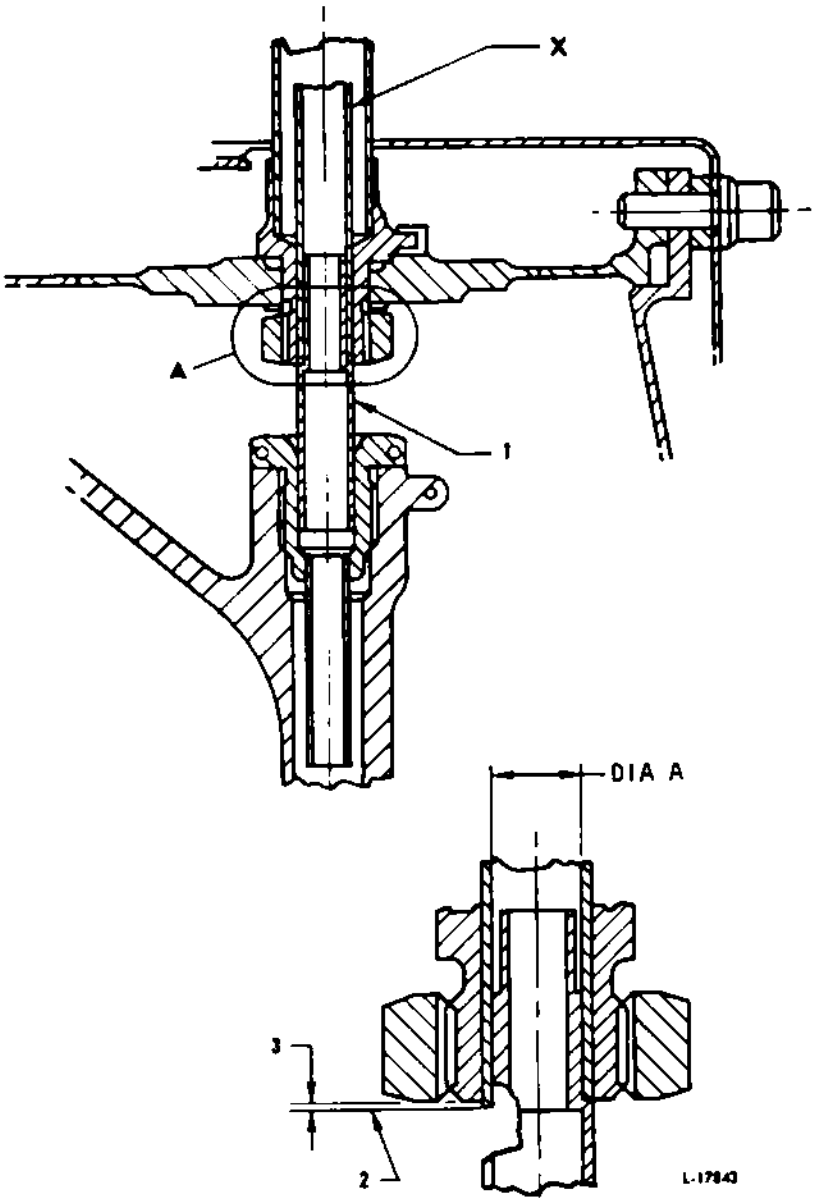
Key to Figure 205 (Sheet 3)



No. 6 Bearing Oil Pump
Removal/Installation
Figure 206
(Task 72-50-00-990-002)

1. Packing
2. No. 6 Bearing Pressure Tube (Oil Damped Bearing Area Only)
3. No. 6 Bearing Scavenge Pump Assembly
4. Pressure Tube Mounting Bolt (Two Required)
5. Pump Assembly Mounting Bolt (Three Required)
6. Washer (Three Required). For Use With Pump Assembly Prior To SB 3845 (Pump Bracket PN 693857 Or Prior)
7. No. 6 Bearing Retaining Plate Oil Transfer Port
8. Pump Cover Bolts (Reference). Do Not Loosen When Removing Or Installing Pump Assembly.
9. Bushing (3)

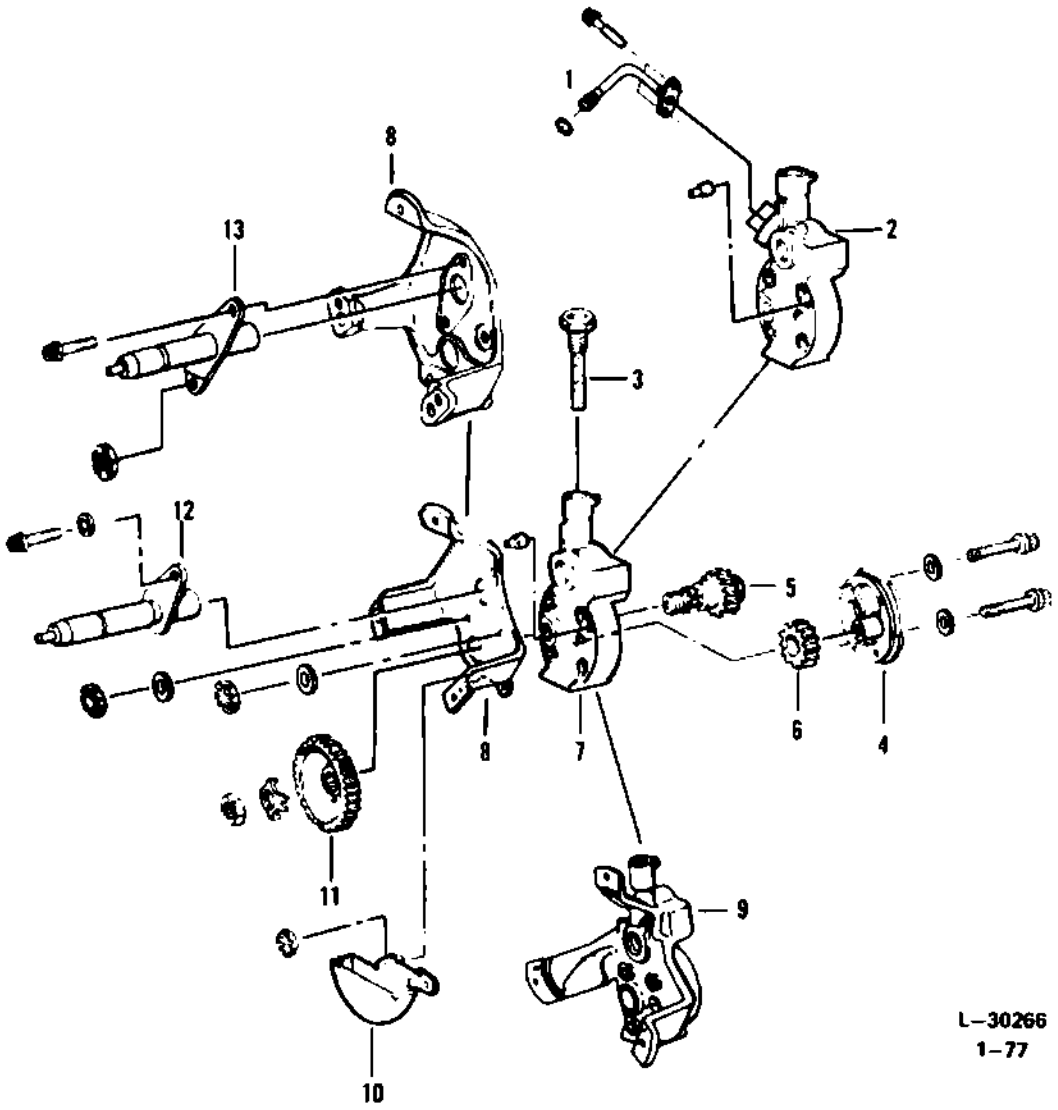
Key to Figure 206



VIEW A

1. PN 532538 Tube. Select Class - Obtain 0.001T to 0.001L Fit With Diameter A (see Text)
2. Remove Bottom Portion of Part Marked X Along This Plane
3. 0.000 - 0.030 Inch

Rework of No. 6 Bearing Inner
Internal Pressure Tube Assembly
Figure 207
(Task 72-50-00-990-002)



No. 6 Bearing Oil
Scavenge Pump Assembly
Figure 208
(Task 72-50-00-990-002)

1. No. 6 Bearing Pressure Tube (For Use With Oil Damped No. 6 Bearing)
2. Pump Housing (For Use With Oil-Damped No. 6 Bearing)
3. No. 4 1/2 Bearing Strainer Element
4. Pump Cover
5. Spur Gearshaft
6. Idler Spur Gear
7. Pump Housing (For Use With Non-Oil-Damped No. 6 Bearing)
8. Pump Bracket
9. Pump Housing With Integral Mounting Legs
10. Pump Gear Shield
11. Pump Drive Spur Gear
12. No. 4 1/2 Bearing Oil Nozzle (Single Hole Type)
13. No. 4 1/2 Bearing Oil Nozzle (Double Hole Type)

Key to Figure 208

TURBINE NOZZLE SECTION - DESCRIPTION-00

Task 72-51-00-990-001:

1. Turbine Section

A. General

(1) The turbine section contains two cases (turbine front case and turbine rear case), an inner case and seal, four stages of turbine vanes, and the turbine rotors with their drive shafts.

B. Turbine Front Case

(1) The turbine front case is secured to the rear of the combustion chamber outer case and is of decreasing diameter from front to rear. It is constructed of corrosion and heat resistant steel. The first stage turbine vanes are bolted into this case.

C. Turbine Rear Case

(1) Secured to the rear of the turbine front case is the larger turbine rear case, constructed of steel. The diameter of this case increases from front to rear to accommodate the second, third, and fourth stage turbine vanes. The rear flange of this case is bolted with the fourth stage turbine outer seal ring, to the front flange of the turbine exhaust case. Holes located in the front inner flange inner flange allow cooling air to flow by turbine rotor airseal and turbine outer rear case. The vanes fit in machined grooves (in the ID of the case) which have anti-torque lug slots for the blade shroud seal rings.

(2) A pin in the front flange (6 o'clock position) and an offset hole in the rear flange position the case correctly in the engine. (Viewed from the rear, the clockwise hole in the lug having only two holes is offset.) Anchor nuts are secured to the inside of the front flange.

D. Turbine Nozzle Inner Case and Seal Assembly

(1) Secured to the outer flange of the No. 5 bearing housing and extending rearward is the turbine nozzle inner case and seal assembly. Riveted to its rear inner flange is the turbine rotor inner first stage airseal, which matches the integral shoulders on the front of the first stage turbine disk.

(2) A groove in the rear outer flange accommodates the inner rear shroud of the first stage turbine vanes. Segmented multiple turbine vane shroud nuts are riveted to the forward outer flange.

E. First Stage Turbine Nozzle

(1) The first stage turbine vanes (and inner duct positioning supports) are held at the inner end to the segmented multiple nuts of the inner case and seal assembly by bolts and lockwire. Later models first stage vanes are air cooled by an internal tube and a series of air exit holes in airfoil trailing edge on the concave side.

(2) Bolts at the outer end hold the vanes in the turbine outer front case. A ring of segmented supports, under the boltheads at the front outer shroud of the vanes, positions the combustion chamber outer outlet duct. The outer shroud of the vanes fits against the Z shaped first stage stator seat positioned inside the turbine case. The vanes are removable from the front.

(3) To the rear of the first stage vanes outer shroud is the first stage turbine rotor outer airseal. This airseal has multiple seals on its ID.

(4) The first stage turbine rotor outer airseal damper, (a gapped steel ring) between the first stage outer airseal and the turbine case controls cooling air flow through this area.

F. Second Stage Turbine Nozzle

(1) There are 95 second stage vanes. The vanes are installed in a grooved shoulder in the ID of the turbine case, held in place by pins in the groove. In front of the vanes, at the outer end, is the gapped second stage vane retaining ring, against the rear of the first stage outer airseal. To the rear of the vanes outer end is the second stage turbine vane lock plate. Behind the lock plate is the second stage outer airseal ring and turbine damper. This ring has two stepped platforms which match the two knife-edge seals on the outer shroud of the second stage turbine blades.

(2) At the inner end, the vanes seat in slots in the second stage turbine vane inner shroud assembly. At its ID, this shroud assembly has three knife-edge seals, two of which match the ID of a flange on the second stage disk and one which matches the OD of an inner flange on the rear of the first stage turbine rotor. Another airseal is mounted on the front portion of the shroud ID and matches the OD of an outer flange on the rear of the first stage turbine rotor.

G. Third Stage Turbine Nozzle

(1) The 79 third stage vanes are held in the turbine case the same as the second stage vanes. There is a gapped retaining ring in front, a lock plate behind, and a stepped third stage outer airseal ring to the rear of the lock plate.

(2) At the inner end, the third stage vanes seat in slots in the turbine rotor third stage inner airseal ring assembly. At its ID this assembly has a double-platform ring which matches the knife-edge seals on the OD of the turbine rotor second-to-third stage inner airseal.

H. Fourth Stage Turbine Nozzle

(1) There are 77 fourth stage vanes positioned in the rear of the turbine case. These vanes mount on pins in the case and against a gapped retaining ring in front. They are held against a rear shoulder in the case by the fourth stage turbine rotor outer airseal ring which is secured to the rear flange of the turbine case by flathead screws. The ring has platforms to match the two seals on the outer end of the fourth stage turbine blades.

(2) At the inner end, the fourth stage vanes seat in the turbine fourth stage inner airseal assembly. This inner airseal ring assembly has a double-platform inner airseal ring which matches the knife-edge seals on the OD of the turbine rotor third-to-fourth stage inner airseal.

I. Turbine Rotors

(1) There are two separate drive turbine rotors, the rear compressor drive (first stage) and the front compressor drive (second, third, and fourth stage). Except for necessary bearing support they are not mechanically connected. They are aerodynamically coupled, since the gases that exhaust from the first stage turbine rotor pass through the second, third, and fourth stages.

J. No. 5 Bearing Housing

(1) Secured to the rear flange of the turbine shafts inner heatshield is the No. 5 bearing housing and the No. 5 bearing seal support assembly. The steel No. 5 bearing housing holds the No. 5 bearing outer race in its ID bore with a retaining nut and rivet. The housing is attached to the rear flange of the combustion chamber inner case, the front flange of the turbine nozzle inner case and seal assembly, and the inner rear flange of the turbine shafts heatshield. The outer front flange of the housing also provides a point of attachment for the inner flange of the nine-hole combustion chamber support.

Task 72-51-21-210-001:

1. Inner And Outer Outlet Duct Continue In Service Limits (Make An Inspection With A Borescope Or Equivalent)

A. Louvered Inner And Outer Outlet Duct Assemblies
See Figure 201.

NOTE: Refer to the figure for the terminology of the combustion chamber outlet ducts as it is used in this inspection procedure. The duct "wall" as it is described in steps (1), (2), (3), (5), (6), and (7) is that part of a duct that isolates the area inside the duct from the area outside the duct. The ducts are made of "liners" which are welded together. When the rear of one liner extends over the next liner, this makes a "louver" which protects the liner to the rear from heat (see step (4) for limits on these louvers).

(1) Axial cracks which go fully across the wall of a duct liner are permitted if:

(a) Material at the crack location is not badly burned.

(b) There are no more than three axial cracks at each combustion chamber outlet location (one crack in each liner), and the cracks in each liner do not connect.

(c) The cracks are not opened.

(2) Circumferential cracks up to two inches (5.1 cm) in the wall of a liner at all combustion chamber positions are permitted if:

(a) Material at the crack location is not burned.

(b) There are no more than three cracks (one crack in each liner) at each combustion chamber outlet location.

(3) Axial and circumferential cracks in the wall of a duct (which are less than the limits in steps (1) and (2), above) which across each other are permitted if:

(a) Material at the cracks is not badly burned or oxidized.

(b) The area of material which is broken away from the duct where the cracks come together is not more than 0.1 x 0.1 inch (2.5 x 2.5 mm).

(4) Louvers which are oxidized or bent are permitted (see Figure 201).

(5) If the ducts have one or more of the defects that follow, examine the ducts again at 500 hours or 500 cycles (when one or the other of these occurs first):

(a) Bad distortion or oxidation in the duct wall (not in the louvers), or material (not in the louvers) which is badly burned. The duct can have bulges (distortion) if there are no cracks and the material is not burned.

(b) Circumferential cracks between two and four inches in length.

(c) Material broken away from the duct, caused by cracks which go across each other, more than the limits in (3) above but less than 0.2 x 0.2 (5 x 5 mm).

(6) If the duct walls have burned-through areas larger than the limits in step (5)(c) above, continue to examine the ducts again at 50 hours or 50 cycle increments, or remove the ducts from service in 50 hours or 50 cycles (when one or the other of these occurs first).

(7) If ducts have circumferential cracks in the liner wall more than four inches in length as found in step (5)(b) above.

(a) If cracks are not more than six inches in length, continue to examine these ducts at 250 hour or 250 cycle increments (when one or the other of these occurs first), but only if these cracks are not at adjacent combustion chamber positions.

(b) If cracks are more than six inches in length, or if they are four to six inches in length and are at adjacent combustion chamber positions:

1 Remove the duct from service in 50 hours or cycles (when one or the other of these occurs first) OR

2 Continue to examine the duct in 50 hour or 50 cycle increments (when one or the other of these occurs first), but remove the duct from service if the cracks increase in length between inspections.

B. Smooth Wall Outer Outlet Ducts (JT8D-1,-1A,-1B,-7,-7A,-7B, -9,-9A Engines)

(1) Axial Cracks

(a) The limits are the same as step 1.A.(1), but each crack must not be more than 1.25 inch (3.2 cm) in length, and the cracks must not come together.

(2) Circumferential Cracks

(a) The limits are the same as step 1.A.(2), but no more than one crack is permitted at each combustion chamber outlet location.

(3) Axial And Circumferential Cracks

(a) The limits are the same as step 1.A.(3), but it will be necessary to inspect the damaged area at 500 hour/500 cycle increments (when one or the other of these occurs first).

(4) Distortion, Burned/Broken Material, And Oxidized Surfaces

(a) The limits are the same as step 1.A.(5), but it will be necessary to examine the damaged area again (or remove the duct) at 250 hours or 250 cycles (when one or the other of these occurs first).

(5) Ducts Burned Through

(a) Same as step 1.A.(6).

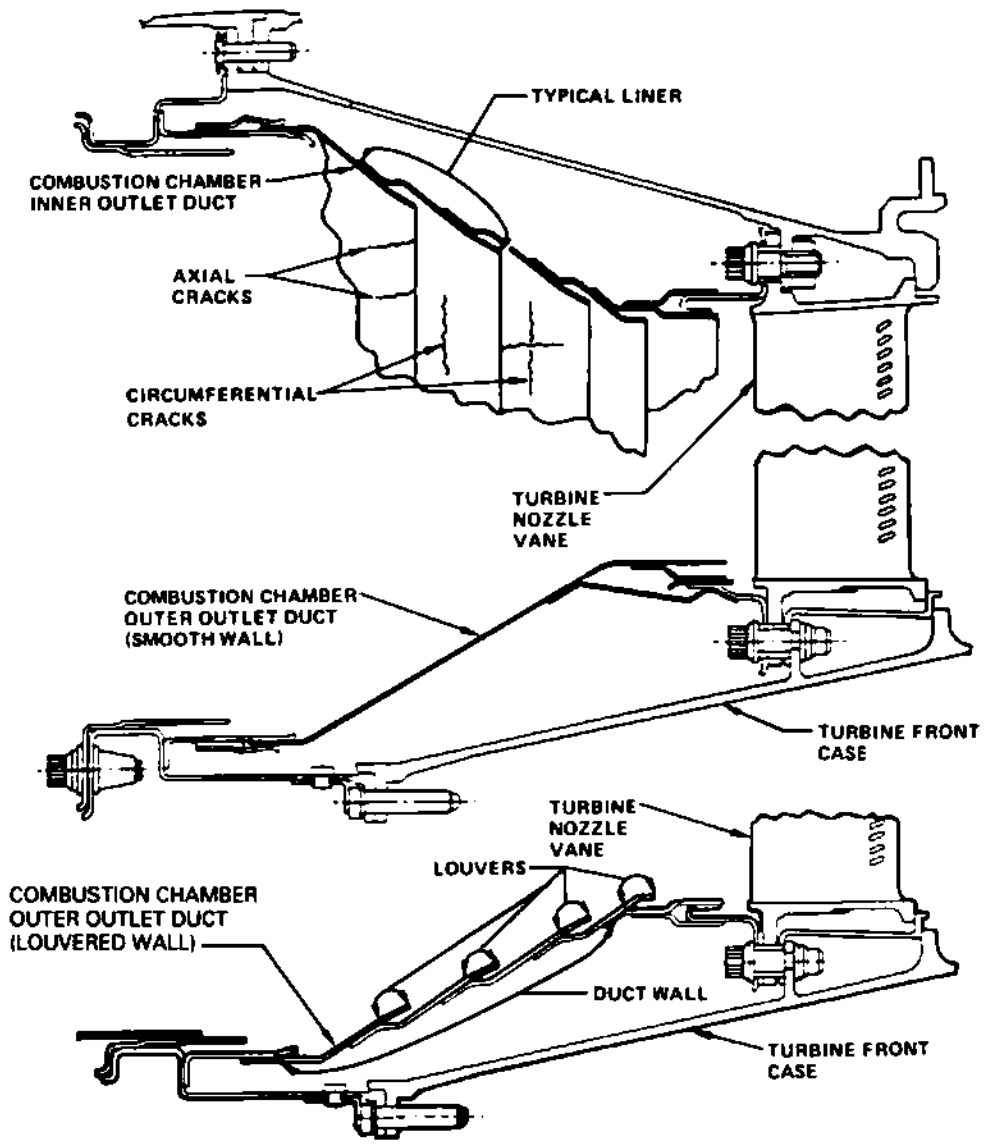
(6) If ducts have cracks (direction is not important) which are more than four inches in length, continue to examine the duct at 50 hour or 50 cycle increments (when one or the other occurs first), or remove the duct before 50 hours or 50 cycles (when one or the other occurs first).

Task 72-51-21-210-002:

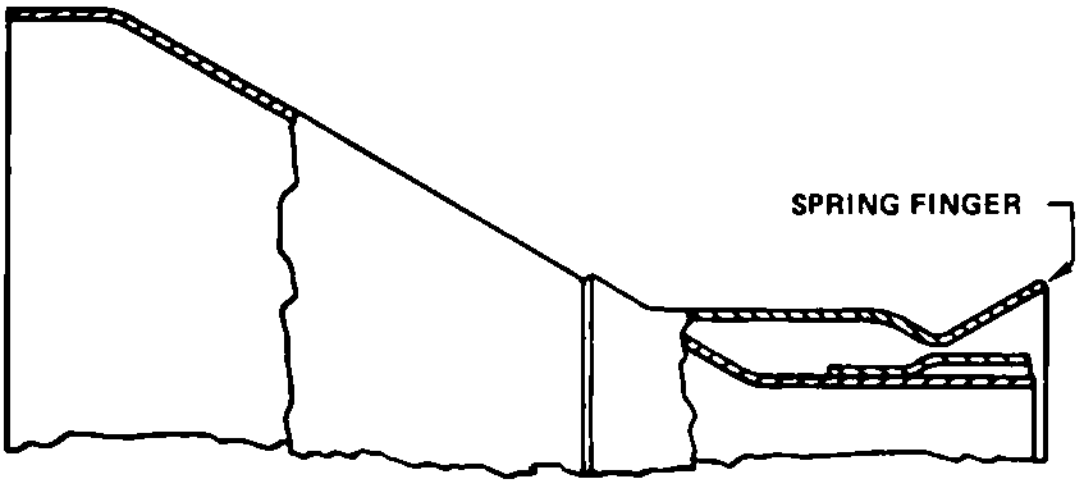
2. Combustion Chamber Outer Outlet Duct

A. Guide (Spring Finger) Breakage Limit
See Figure 202.

(1) Operation of part is permissible with all guides (fingers) missing as long as part is replaced or repaired at time of overhaul.



Inner And Outer Outlet Ducts
Continue In Service Limits
Figure 201
(Task 72-51-21-210-002)



Combustion Chamber Outer Outlet Ducts (Spring Finger) - Breakage Limit
Figure 202
(Task 72-51-21-210-002)

REAR COMPRESSOR DRIVE TURBINE ROTOR - DESCRIPTION-00

Task 72-52-00-990-001:

1. Rear Compressor Drive Turbine Rotor

See Figure 1.

A. General

(1) In JT8D-1,-1A,-1B,-7,-7A, and -7B engines not incorporating SB 4087, the rear compressor drive turbine rotor consists of an integral rear compressor drive turbine shaft and 1st stage disk. In later engines, and engines incorporating SB 4087, this shaft and disk are separate and are held together by 18 equally spaced tiebolts, tabwashers, and nuts. In all engines the 1st stage blades are held in fir tree slots by rivets and washers. Later engines (and JT8D-1, -1A, and -1B engines which incorporate a back-up carbon seal at the No. 5 bearing) are equipped with a spacer and an airseal between the seal face plate and the shoulder of the turbine shaft.

(2) Counterweights may be secured to the rear flange of the shaft to obtain optimum rotor balance.

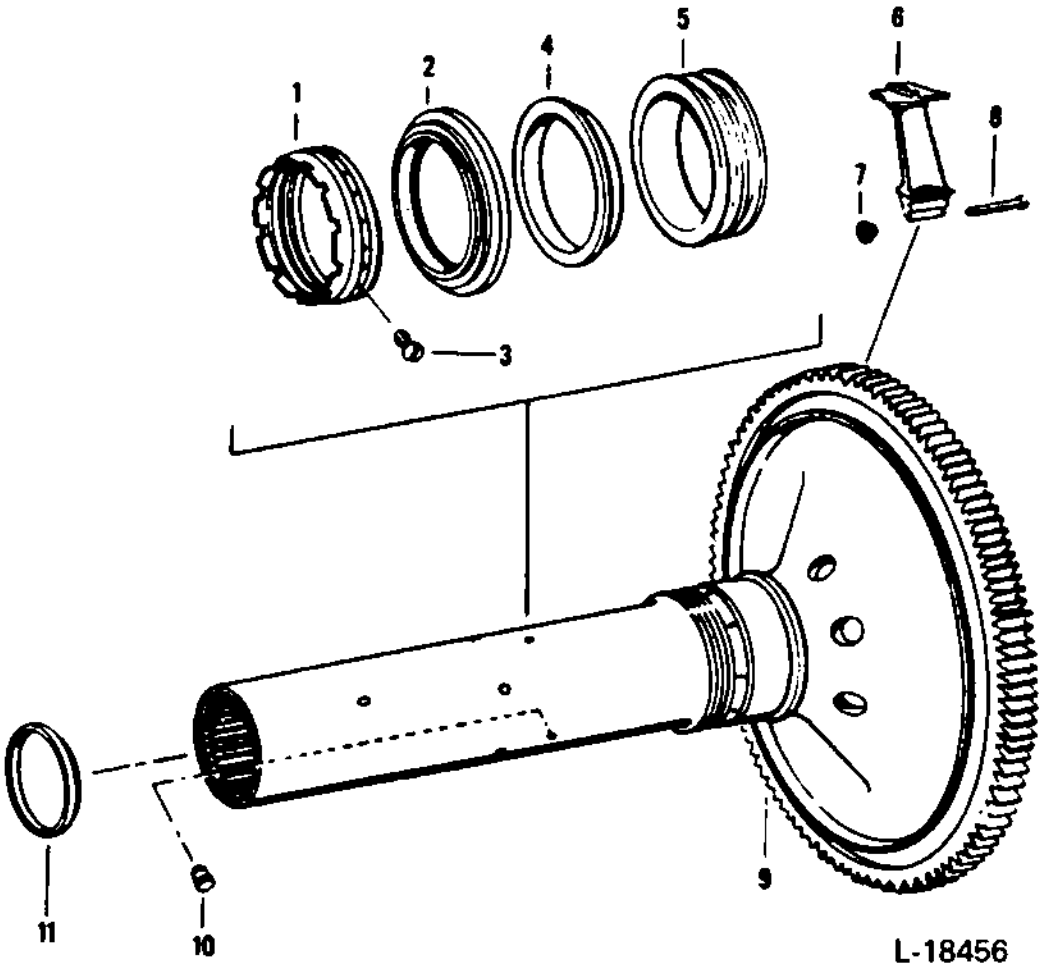
(3) At assembly, the turbine shaft splines onto the rear compressor rear hub and is retained by the rear compressor drive turbine shaft coupling.

(4) Turbine position in the turbine case is determined by a ring-shaped spacer that is between the rear face of the compressor rear hub shaft and an internal shoulder in the turbine shaft.

B. Rear Compressor Drive Turbine Shaft Coupling

(1) A steel rear compressor drive turbine shaft coupling secures the rear compressor drive turbine shaft to the rear compressor. The rear compressor rear hub has an OD spline which mates with the rear compressor drive turbine shaft front ID. The coupling has a left hand thread at the front and a shoulder which holds the shaft to the rear compressor rear hub. It has a wrench spline in its ID and multiple oil holes at the rear. The coupling is silver plated.

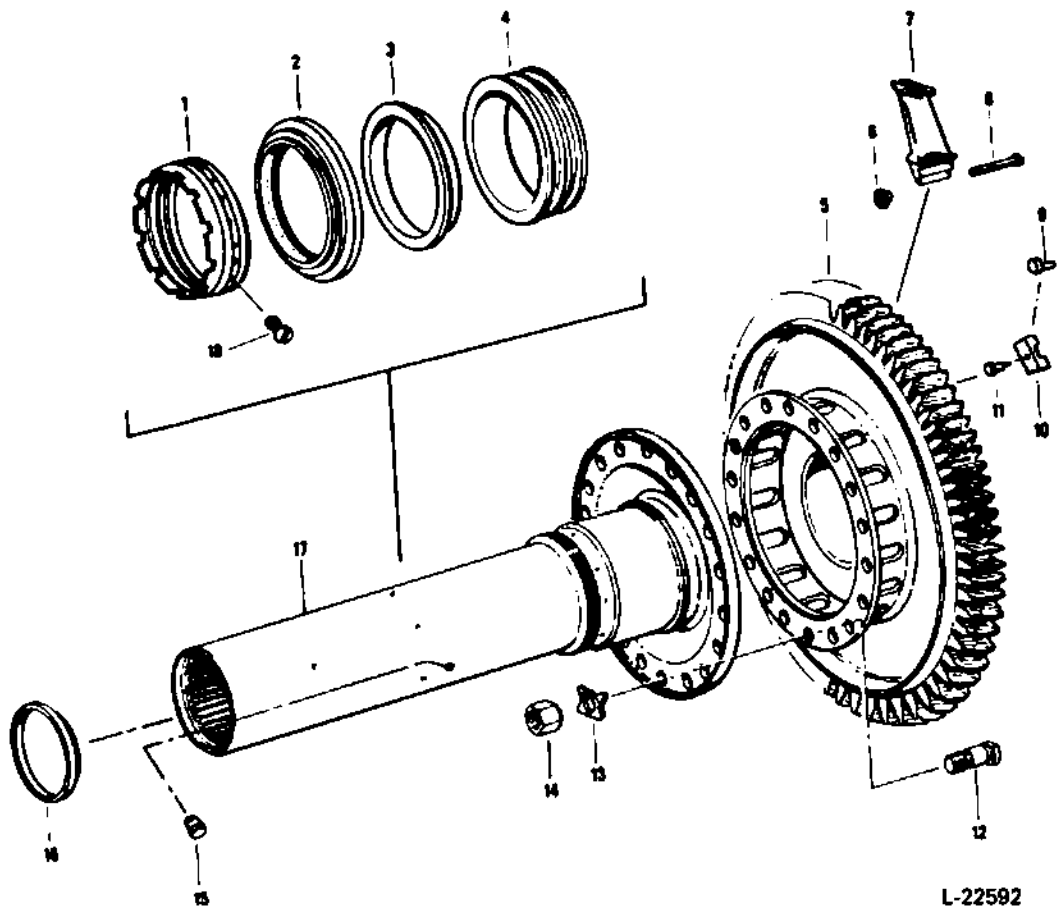
REAR COMPRESSOR DRIVE TURBINE ROTOR - DESCRIPTION-00



1. No. 5 Bearing Inner Race Nut
2. Seal Seat (Plate)
3. Nut Retaining Screw (2)
4. Spacer
5. Air Seal
6. First Stage Turbine Blade
7. Washer
8. Turbine Blade Rivet
9. Rear Compressor Drive Turbine Shaft
10. Positioning Plug
11. Turbine Shaft Spacer

Rear Compressor Drive Turbine
Rotor (Integral Hub and Shaft)
Figure 1 (Sheet 1)
(Task 72-52-00-990-001)

REAR COMPRESSOR DRIVE TURBINE ROTOR - DESCRIPTION-00



Rear Compressor Drive
Turbine Rotor Assembly
(Separable Hub and Shaft)
Figure 1 (Sheet 2)
(Task 72-52-00-990-001)

1. No. 5 Bearing Inner Race Retaining Nut
2. Seal Seat
3. Bearing Spacer
4. Labyrinth Seal
5. First Stage Turbine Disk
6. Washer
7. First Stage Turbine Blade
8. Rivet
9. Counterweight
10. Counterweight
11. Rivet
12. Tiebolt
13. Keywasher
14. Tierod Nut
15. Positioning Plug
16. Turbine Shaft Spacer
17. Rear Compressor Drive Turbine Shaft
18. Retaining Screw

Key to Figure 1 (Sheet 2)

FRONT COMPRESSOR DRIVE TURBINE ROTOR - DESCRIPTION-00

Task 72-53-00-990-001:

1. Front Compressor Drive Turbine Rotor

See Figure 1.

A. The front compressor drive turbine rotor includes the front compressor drive turbine shaft, the second, third, and fourth stage turbine disks and blades, and the spacers and airseals between the disks. Twelve tierods secure the disks and spacers to each other and to the rear flange of the rotor shaft, and a trumpet-shaped turbine bearings pressure and scavenge oil tubes assembly is positioned inside the shaft.

B. The blades, are secured in the disks with rivets; 88 blades in the second stage, 92 blades in the third stage, and 74 blades in the fourth stage. Provisions are made for rotor counterweights on the front face of the second stage disk and the rear face of the fourth stage disk.

C. The second stage disk has 88 "fir tree" serrated slots around the OD. The disk is made of steel and has a scalloped flange on the front which accommodates rotor counterweights. A flange on the rear has 12 tierod holes, one of which is offset and is identified by an adjacent dimple, and nine counterweight holes.

D. The third stage disk, manufactured of steel, has 92 "fir tree" serrated slots around the OD. The disk has 12 tierod holes, one of which is offset and is identified by an adjacent dimple. Twelve counterweight holes are located between the tierod holes. The disk has shoulders near the OD for the mating inner airseals and spacers.

E. Lugs on the second and third stage turbine rotor inner airseals mate with slots on the second and third stage disks and prevent rotation between the disks and seals.

F. At the fourth stage the turbine rotor rear hub, made of steel, incorporates an integral disk having 74 "fir tree" serrated slots around the OD. The hub has 12 tierod holes (one offset) and 12 counterweight holes through the thick portion of the disk web. A scalloped flange at the rear has holes for mounting rotor balance counterweights. There are eight equally spaced threaded holes on the rear face of the hub used to secure the No. 6 bearing oil scavenge gearshaft in place.

G. The No. 6 bearing spacer mounts on the small diameter of the hub with the No. 6 bearing behind it. Both are held on the hub by the oil scavenge gearshaft, bolted and locked with keywashers.

Task 72-53-00-990-002:

2. Front Compressor Drive Turbine Rotor and Stator Assembly (Unit Turbine)

See Figure 2.

A. Later engines (and certain JT8D-1,-1A,-1B,-7,-7A, and -7B engines) are equipped with a front compressor drive turbine rotor and stator assembly (unit turbine). This turbine differs from a standard turbine in that the turbine case parting surfaces are arranged so that the low pressure turbine may be assembled and installed in the engine as a unit. The assembly includes a rear turbine case, the 2nd, 3rd, and 4th stage turbine vanes and inner stator shrouds, the front compressor drive turbine shaft, 2nd and 3rd stage turbine disks and blades, 4th stage hub and blades, shaft-to-3rd and 3rd to 4th stage spacer, and air seals between the disks.

B. The front compressor drive turbine shaft is made of steel. It is a long shaft which is positioned inside the rear compressor drive turbine shaft and extends from the 2nd stage turbine disk to the front compressor rotor rear hub.

C. Located on the OD of the shaft, about one third of the way forward, is a machined diameter, on which are installed the No. 4 1/2 bearing (turbine intershaft) inner race, seals, and seal spacers. The seals and the bearing are held on the shaft by a large nut with oil holes, secured with a tablock and snapring.

D. At the front of the machined diameter are two groups of five oil holes, equally spaced, through the wall of the shaft. At the rear of the machined diameter is a group of five smaller holes which pass through the shaft wall at an angle. Oil flows forward through a trumpet-shaped turbine bearings pressure and scavenge oil tube assembly then through these holes to the No. 4 1/2 bearing area.

E. The flange at the rear of the shaft has 12 tierod holes, and three equally spaced holes for screws which secure the 2nd stage disk to the shaft. In addition, the flange has nine shallow holes to accommodate counterweights as required on the rear flange of the 2nd stage disk.

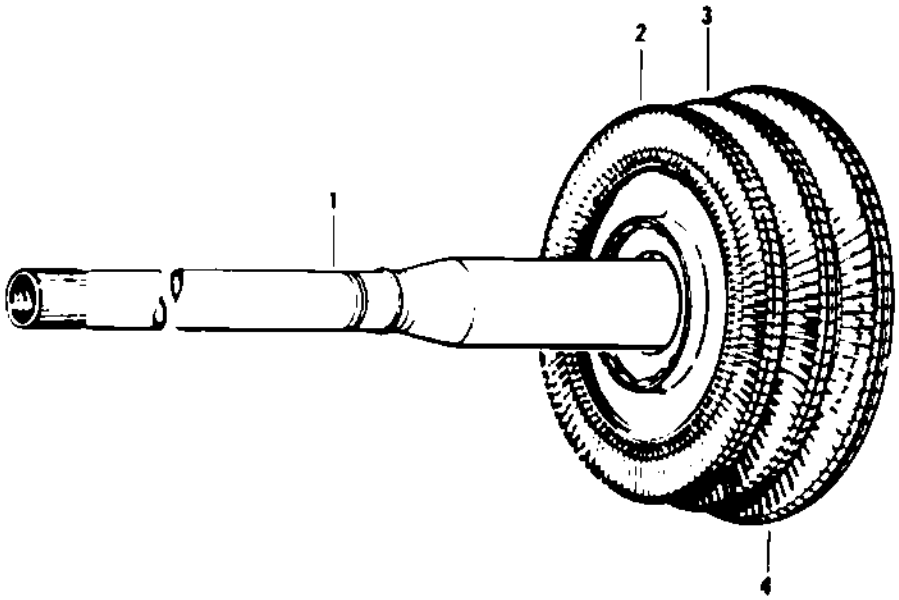
F. Turbine Bearings Pressure and Scavenge Oil Tubes Assembly

(1) This unit, shaped like a long, slender trumpet, is positioned inside the front compressor drive turbine rotor. Two long scavenge tubes and a shorter pressure tube carry oil between the No. 4 1/2 and No. 6 bearing areas as described with the Lubrication System in Section 72-00-00, Engine - Description.

G. Front Compressor Drive Turbine Shaft Coupling Arrangement

(1) The front compressor drive turbine shaft splines into the front compressor rotor rear hub. The shaft and hub are secured together by the arrangement described with the front compressor rotor rear hub coupling in Compressor Section, 72-33-00.

FRONT COMPRESSOR DRIVE TURBINE ROTOR - DESCRIPTION-00

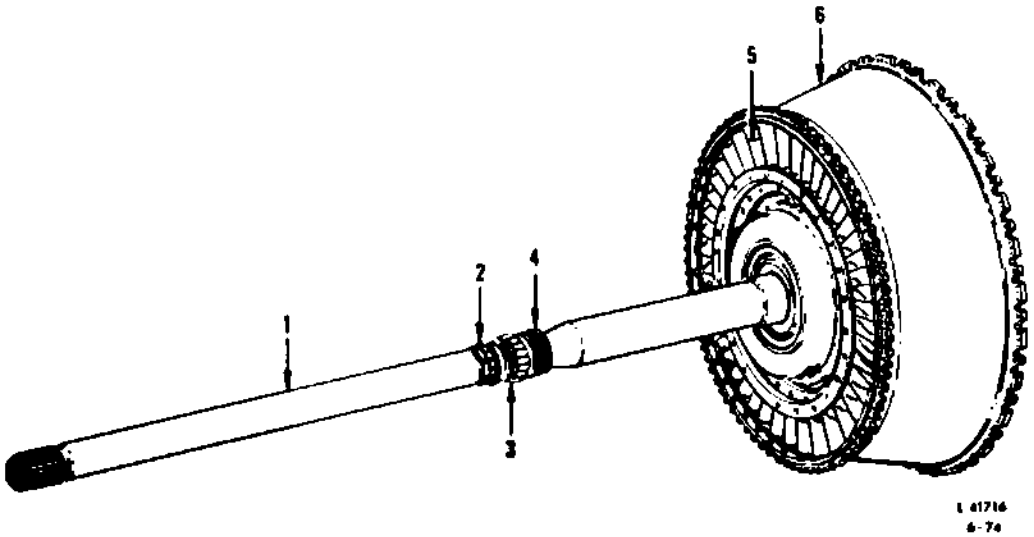


1. FRONT COMPRESSOR DRIVE TURBINE SHAFT
2. SECOND STAGE TURBINE DISK AND BLADES
3. THIRD STAGE TURBINE DISK AND BLADES
4. TURBINE REAR HUB (FOURTH STAGE DISK) AND BLADES

I-11358

1. Front Compressor Drive Turbine Shaft
2. Second Stage Turbine Disk and Blades
3. Third Stage Turbine Disk and Blades
4. Turbine Rear Hub (Fourth Stage Disk) And Blades

Front Compressor
Drive Turbine Rotor
Figure 1
(Task 72-53-00-990-002)



1. Front Compressor Drive Turbine Shaft
2. No. 4 1/2 Bearing Retaining Nut
3. No. 4 1/2 Bearing Inner Race And Rollers
4. No. 4 1/2 Bearing Carbon Seals
5. Second Stage Turbine Vanes
6. Turbine Nozzle Case

Front Compressor Drive
Turbine Rotor And Stator
Assembly (Unit Turbine)
Figure 2
(Task 72-53-00-990-002)

TURBINE EXHAUST CASE ASSEMBLY - DESCRIPTION-00

Task 72-54-00-990-003:

1. Turbine Exhaust Case

   A. At the rear of the basic inner section of the engine, bolted to the rear flange of the turbine case, is the welded steel turbine exhaust case. This case decreases in diameter from front to rear, has a double flange mount ring encircling it near the center, and has outer flanges at the front and rear. The front flange has a snap diameter and boltholes with one hole offset next to the six o'clock position. The rear flange is scalloped and has locknuts held securely in place by rivets.
   See Figure 1.

   B. Eight thermocouple inner bosses are welded on the OD of the case just behind the mount ring flanges and strut retaining pin bosses are located at the three, six and nine o'clock positions. An oil pressure tube boss is located behind the mount ring flanges at the 12 o'clock position. Six pressure probe bosses are located forward of the mount ring flanges. The case incorporates an internal grooved ring near the front flange which engages and locks the rear edge of the fourth stage turbine rotor outer airseal ring.

   C. The turbine average pressure sensing manifold is mounted around the turbine exhaust case, forward of the mounting flanges. It connects to the pressure probes bolted to the case and, at the outer end, to a fitting near the bottom of the fan discharge turbine exhaust outer duct.

Task 72-54-00-990-004:

2. Turbine Exhaust Strut Assembly

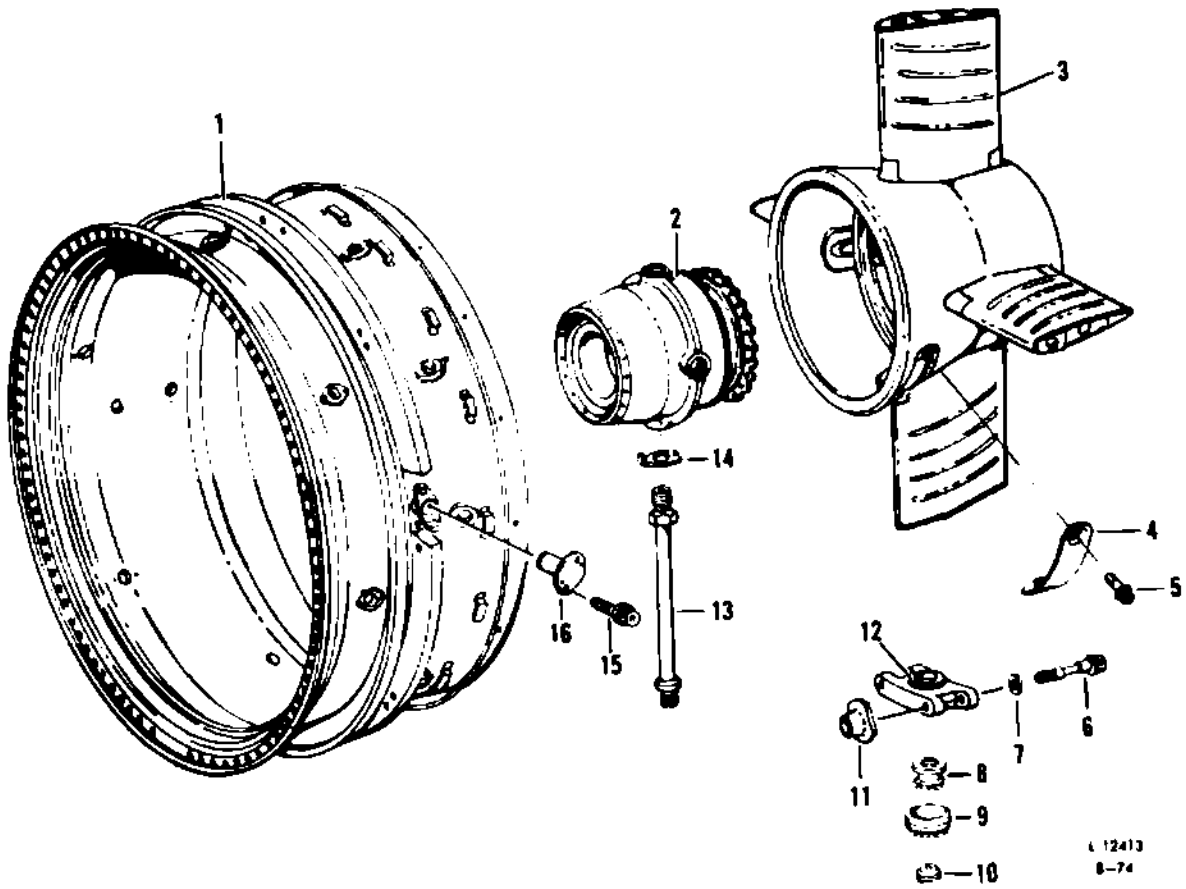
   A. The steel turbine exhaust strut assembly, an inner exhaust duct with four turbine exhaust struts welded to its outer surface, is positioned inside the turbine exhaust outer case. The inner exhaust duct rear flange is equipped with anchored locknuts which facilitate assembly and disassembly.

   B. Four No. 6 bearing support rods pass through the struts, and through holes in the turbine exhaust case, and are secured in strut supports between the exhaust case mounting flanges at the 12, 3, 6, and 9 o'clock positions. The rods are held securely by a dual nut locking arrangement in the strut supports. At the inner end the rods thread into the No. 6 bearing support and are held securely with keywashers.

C. At the 12 o'clock position, to the rear of the support rod, the No. 6 bearing pressure oil tube passes from outside the exhaust case through the strut to the No. 6 bearing support.

D. The No. 6 bearing oil scavenge pump is bolted to the rear of the No. 6 bearing support.

TURBINE EXHAUST CASE ASSEMBLY - DESCRIPTION-00



1. Turbine Exhaust Case
2. No. 6 Bearing Housing
3. Turbine Exhaust Duct and Fairing Assembly
4. Turbine Exhaust Fairing Access Cover Plate (If Used)
5. Cover Plate Bolt
6. No. 6 Bearing Support Rod Boss Bolt
7. Washer
8. No. 6 Bearing Support Rod Locking Nut
9. No. 6 Bearing Support Rod Externally Threaded Ring
10. No. 6 Bearing Support Rod Plug
11. No. 6 Bearing Support Rod Boss Plate Nut
12. No. 6 Bearing Support Rod Boss
13. No. 6 Bearing Support Rod
14. No. 6 Bearing Support Rod Key Washer
15. Turbine Exhaust Fairing Pin Bolt
16. Turbine Exhaust Fairing Pin

Turbine Exhaust Case
and Fairing Assembly
Figure 1
(Task 72-54-00-990-004)

Task 72-54-00-220-001:

1. Turbine Exhaust Fairing Retaining Pin Wear

See Figure 201.

A. Wear Limits

(1) Maximum acceptable wear is 0.015 inch on OD.

(2) Reject any parts worn over maximum amount.

Task 72-54-00-220-002:

2. Turbine Exhaust Fairing Bushing Wear

See Figure 201.

A. Wear Limits

(1) Maximum acceptable wear is 0.015 inch on the diameter.

(2) Reject any parts worn over maximum amount.

Task 72-54-00-220-003:

3. Pin to Bushing Clearance

See Figures 201 and 202.

A. Wear Limits

(1) Maximum acceptable clearance between pins and bushings is 0.030 inch on diameter.

(2) Procedures for checking wear.

(a) Check relative movement between each vane and exhaust case by securing a dial indicator to exhaust case as shown in Figure 202.

(b) As an alternate to step (a), measure relative movement trailing edge of turbine exhaust fairing. See Figure 201. Maximum acceptable movement at tip of tail cone is 0.070 inch in the horizontal or vertical directions. This indicates a pin clearance of approximately 0.030 inch.

Task 72-54-00-210-001:

4. Turbine Exhaust Duct and Fairing Struts Crack Limits And Repair (Sheet Metal Only)

A. Cracks in the turbine exhaust duct and fairing assembly (sheet metal areas only) can continue in service with these limits:

(1) Stop drill all cracks with a 0.125 inch (3.175 mm) diameter drill.

(2) If there are cracks between 1.00 inch (25.400 mm) and 3.00 inches (76.200 mm), do a crack inspection every 750 hours.

(3) Weld repair cracks that are longer than 3.00 inches (76.200 mm) within 100 hours. See the next paragraph for a repair procedure, or remove the part for a shop repair (refer to the JT8D Engine Manual).

B. Repair Procedure

CAUTION: IF EXHAUST DUCT AND FAIRING IS A REAR-SUPPORTED TYPE (PRIOR TO SB 3183), REMOVE ALL DUCT RETAINING PINS AND ENSURE PIN BUSHING HOLE IS ALIGNED TO EXHAUST CASE PIN BOSS HOLE, AS EVIDENCED BY EASE OF PIN INSERTION AND ROTATIONAL MOVEMENT.

(1) Using 0.125 inch drill, stop drill and weld cracks in fairing struts (with fairing installed). See Table 201 for weld rod material.

PN	WELD ROD	PN	WELD ROD
491653	AMS 5680	709136	AMS 5798
491679	AMS 5680	710128	AMS 5798
496511	AMS 5680	756854	AMS 5798
523798	AMS 5680	766291	AMS 5680
558671	AMS 5680	766293	AMS 5680
559493	AMS 5680	766295	AMS 5680
576777	AMS 5680	779174	AMS 5680
593217	AMS 5798	779180	AMS 5680
639409	AMS 5680	779181	AMS 5680
639410	AMS 5680	779183	AMS 5680
639602	AMS 5798	779184	AMS 5680
655987	AMS 5798	779185	AMS 5680
656238	AMS 5798	779193	AMS 5680
656239	AMS 5680	784424	AMS 5798

Turbine Exhaust Case Crack Repair - Weld Rod Material
Table 201

	PN	WELD ROD	PN	WELD ROD
(CONTINUED)				
	656860	AMS 5798	784425	AMS 5798
	709134	AMS 5798	784426	AMS 5798
	709135	AMS 5680		

Turbine Exhaust Case Crack
Repair - Weld Rod Material
Table 201 (Continued)

Task 72-54-00-210-002:

5. Turbine Exhaust Duct And Fairing Mount Boss Crack Limits

See Figure 203.

A. Cracks Present In Exhaust Duct And Fairing Mount Boss May Continue In Service Provided Following Limits Are Met:

(1) Crack length does not exceed 1.000 inch.

(2) Cracks 1.000 - 1.500 inch must be inspected every 750 hours.

(3) Cracks 1.500 - 2.000 inch must be repaired in less than 50 hours.

(4) Cracks more than 2.000 inch must be repaired immediately.

(5) Crack is contained within mount boss casting and does not extend into sheet metal of strut fairing. Cracks in sheet metal fairing may be repaired according to limits of Paragraph 4.

(6) All four mount bosses can be cracked.

(7) Exhaust duct and fairing assembly with mount boss cracks exceeding above limits must be removed from service and repaired per JT8D Engine Manual.

Task 72-54-00-220-004:

6. Turbine Exhaust Strut Rod Wear And Blend Limits

A. Repair or replace worn, damaged, or repaired strut rods.

(1) Worn areas along the strut may be blended to a maximum depth of 0.045 inch.

(2) Strut rods worn in excess of 0.045 inch depth must be removed from service.

(3) Strut rods previously weld repaired must be removed from service at next area exposure and scrapped. See Figure 204.

Task 72-54-00-210-003:

7. Turbine Exhaust Tangential Strut Rod Looseness Check (Mounted Engine)

A. If turbine exhaust tangential strut rod nuts are found loose at one or two exhaust strut rod positions after the engine is attached to the rear mount (and the engine has no reports of vibration), do as follows:

(1) If nuts are loose, tighten nut to 5 - 10 lb-in. and lockwire.

(2) If struts are loose, and there is no access to the nuts (or if the nuts are seized), the engine can continue in service if the nuts are not turned away from the duct surface (there must be no gap between the nut and the duct), and the lockwire is in position.

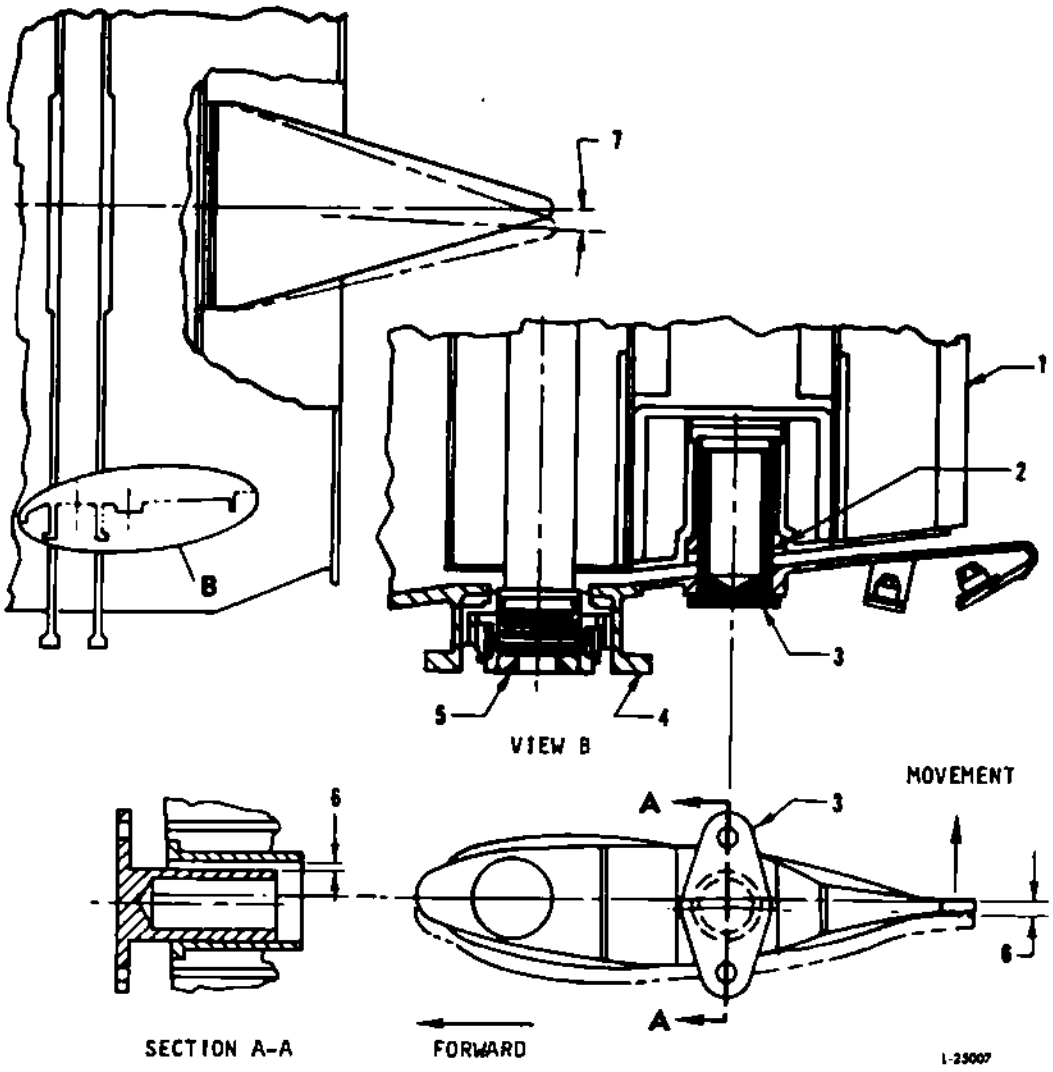
(3) Engine may be kept in service until such time as conditions warrant removal of turbine exhaust case and duct assembly. At that time engine records shall instruct that strut rod nuts be torqued again to original requirements.

Task 72-54-00-990-002:

8. Numerical Tool List

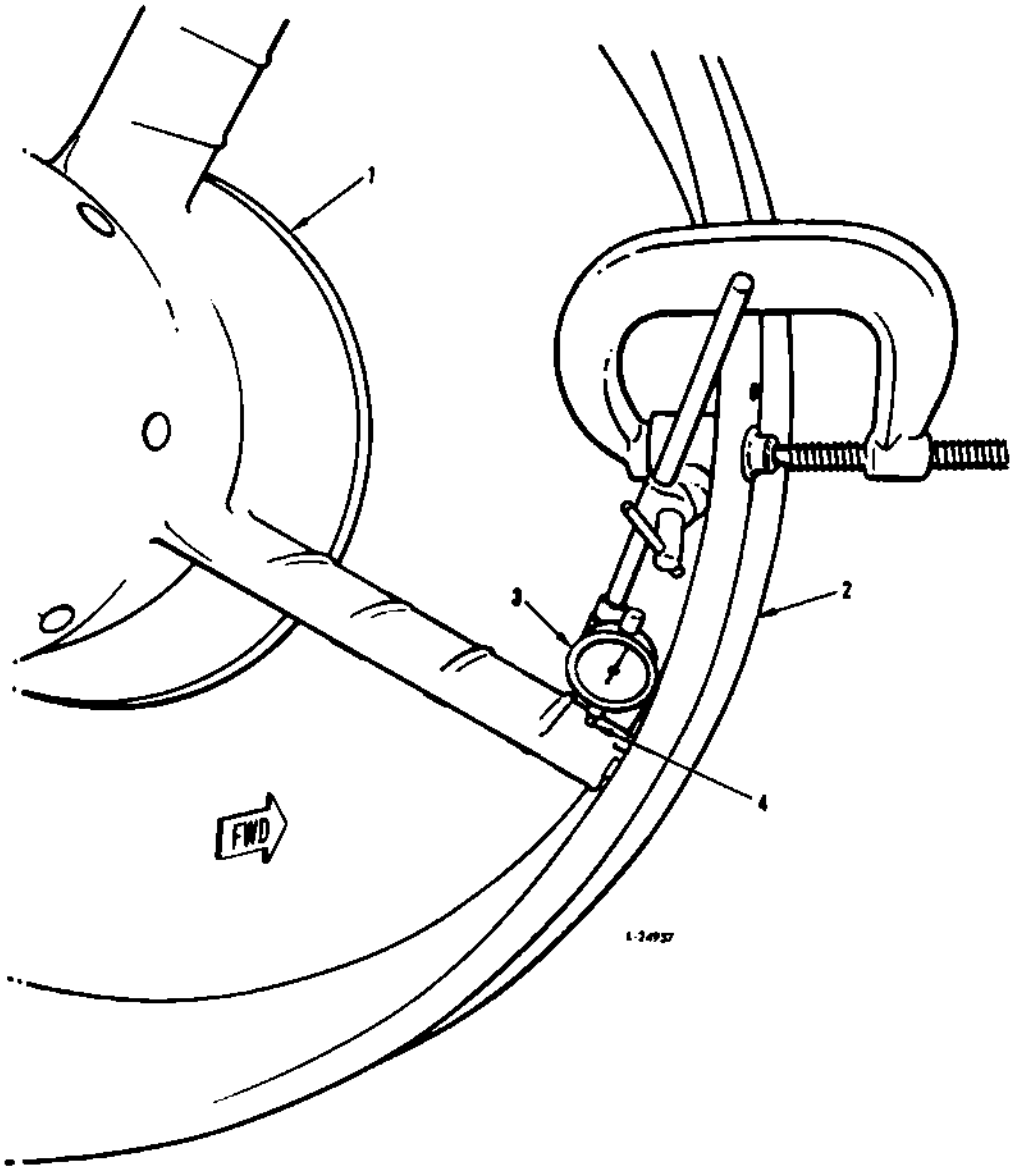
A. Tools

PWA 32631 (Deleted)
PWA 32632 (Deleted)



1. Turbine Exhaust Fairing (Trailing Edge)
2. Bushing
3. Turbine Exhaust Fairing Pin
4. Turbine Exhaust Case
5. No. 6 Bearing Support Rod
6. 0.030 Inch (Approx.) When Maximum Movement is Reached (Typical Four Places).
7. 0.070 Inch Maximum Acceptable Movement at Tip of Tail Cone.

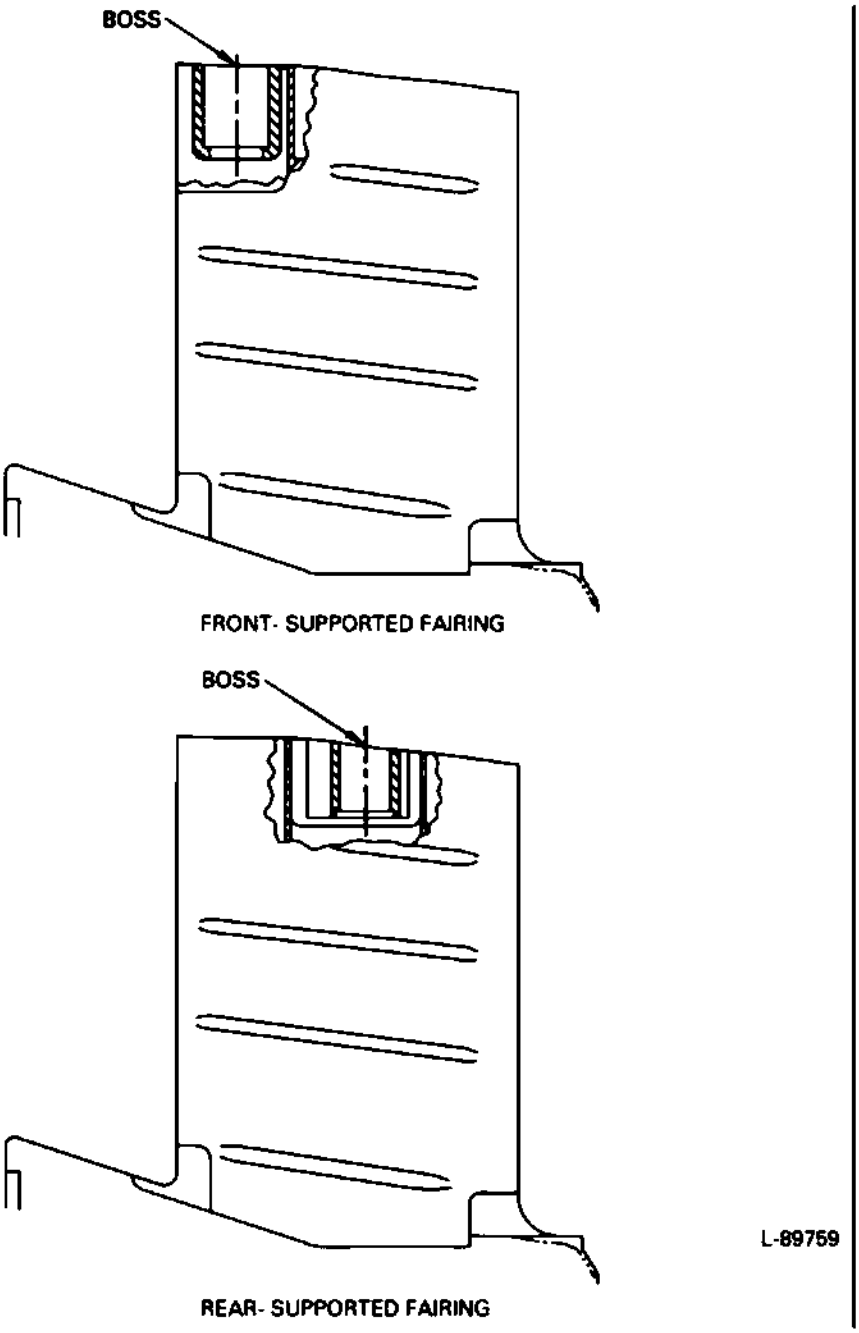
Turbine Exhaust Fairing
Retaining Pin/Bushing Wear Check
(At Fairing Trailing Edge)
Figure 201
(Task 72-54-00-990-002)



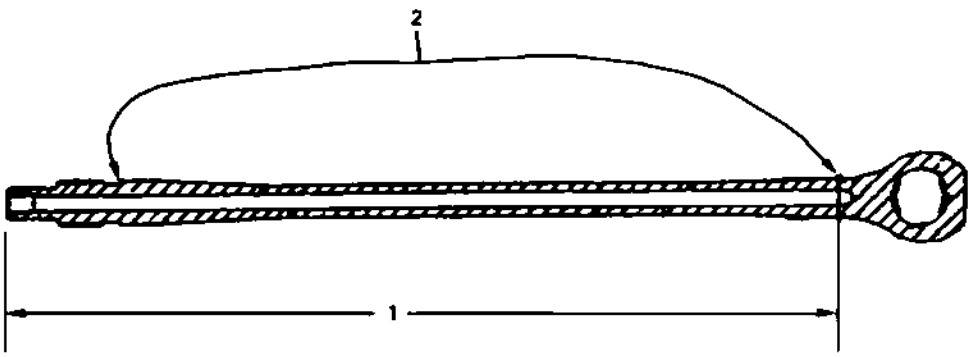
Turbine Exhaust Fairing
Retaining Pin/Bushing Wear Check
Figure 202
(Task 72-54-00-990-002)

1. Turbine Exhaust Fairing (Front)
2. Turbine Exhaust Case
3. Dial Indicator
4. Gage Contact Point at Centerline of Fairing Bushing

Key to Figure 202



Turbine Exhaust Fairing Mount Boss
Figure 203
(Task 72-54-00-990-002)



L-H3300 (0397)

1. 11.620 Inch
2. Blending Permitted In This Area

Turbine Exhaust Strut Rod
Figure 204
(Task 72-54-00-990-002)

Task 72-55-00-420-001:

1. Mixer Replacement (Engines With Mixer)

A. Removal

(1) Attach sling and hoist to fan and turbine exhaust duct at rear of mixer.

(2) Loosen and remove four screws and nuts securing fan and turbine exhaust mixer assembly.

NOTE: An engine for the center position on a Boeing 727 with SB 5846 or SB 5947 will have an outer fan exhaust duct bolted through the fan and turbine exhaust duct guide into the fan exhaust outer duct rear flange (Flange M). Remove the bolts from this duct and remove the duct from the engine. See Figure 201.

NOTE: An engine for the right or left (pod) position on a Boeing 727 with SB 5846 or SB 5947 will have a "wedge ring" (supplied by the airframe manufacturer) between the mixer and the outer duct. See Figure 201. Remove the outer duct from this ring and remove the ring from the fan exhaust outer duct rear flange (Flange M).

(3) Move assembly rearward and place on pallet front side up.

B. Disassembly
See Figure 202.

(1) Remove fan turbine exhaust duct guide.

(a) Position fan and turbine exhaust mixer on bench front side up.

(b) Loosen and remove bolts securing fairing assemblies to duct.

(c) Remove fairing assemblies, then remove guide from duct.

(2) Remove duct segments from duct.

(a) Remove screws (and washers for Post-SB 6057 assemblies) at overlap joints securing duct segments together.

(b) Remove screws securing duct segments to duct, then remove ducts.

C. Assembly (Other Than B737 LGW Installations)
See Figure 204.

NOTE: Refer to Paragraph D. for assembly procedures applicable to the B737 LGW mixer installation.

(1) Install duct segments to fan and turbine exhaust duct.

(a) Position fan and turbine exhaust duct on bench front side up.

(b) Locate boss on duct with dowel pin facing up and mark with crayon.

(c) Install the upper rear duct segment with scallops down aligning first full scallop on left at segment with boss marked in step (b). See Figure 204.

(d) Attach the duct segments to the duct with screws (or bolts) and washers handtight, at all locations except the overlap joints. See Figure 202.

NOTE: Assemblies post-SB 6057 have washers under the screws. On assemblies post-SB 6383 the Torx T20 screws are replaced with bolts. On an assembly post-SB 6146, be sure that the washers are the correct part number (SB 6146 changes the duct segment material from aluminum to titanium, and different washers are necessary).

(e) Install the right rear duct segment to the left of the segment installed in step (c). Install screws (or bolts) and washers (if post-SB 6057) handtight at all locations except overlap joints. See Figure 202.

(f) Install the remaining lower segment to the left of the rear segment installed in step (e). Install screws (or bolts) and washers (if post-SB 6057) handtight at all locations except overlap joints. See Figure 202.

(g) Install screws (or bolts) and washers in the overlap joints. Handtighten the screws or bolts.

NOTE: To get the maximum clearance between duct segment rear edges and the mixer, push the duct segments forward before the screws are tightened.

(h) Torque all screws or bolts.

(2) Install fan turbine exhaust duct guide. See Figures 202 and 203.

(a) Locate lug with longer slot or guide and mark with crayon.

(b) Position guide on duct, rear side down with lugs up, aligning marked duct boss and marked lug on guide. Longer slot on guide mates with dowel pin of duct.

NOTE: When the engine is post-SB 5947, for a Boeing 737 which will have the NORDAM ejector/suppressor, align the guide of the mixer assembly as shown in Figure 203 for a right or left engine, as applicable. The guide has marks for "TDCLHS" (top dead center left hand side) and "TDCRHS" (top dead center right hand side). PN 812024 guide (see Sheet 2 of the figure) has the letters "MIRHS" (mixer index right hand side) and "MILHS" (mixer index left hand side) to show where the long slot on the guide is found for right or left side mixer installations. Put the dowel pin on the duct in the guide slot that has the mark for right or left installation. Use a tag or mark to show that this mixer is for right or left side installation.

(c) Secure guide to duct assembly with fairing assemblies aligning dowel pins in fairings with dowel pin holes in duct bosses. Install and torque bolts.

D. Assembly (B737 Low Gross Weight Installations)
See Figures 204 thru 206.

NOTE: Refer to Paragraph C. for assembly procedures applicable to mixer installations other than the B737 LGW mixer installation.

(1) Attach the mixer guide to the mixer with 12 fairing assemblies and 12 bolts. See Figure 202.

NOTE: Left engine installations: Align the guide with the "MILHS" (mixer index left hand side) mark at the guide pin (found on the guide vane of the mixer) as shown in Figure 206 (Sheet 1).

NOTE: Right engine installations: Align the guide with the "MIRHS" (mixer index right hand side) mark at the guide pin (found on the guide vane of the mixer) as shown in Figure 206 (Sheet 2).

(2) Loosely attach the three duct segments to the mixer with 33 screws and washers (see Figure 205). Do not tighten the screws until the mixer is fully installed.

(a) Left engine installation: Align the shiplap joint that connects the upper right duct segment with the guide pin on the mixer. See Figure 206 (Sheet 1).

(b) Right engine installation: Align the shiplap joint that connects the upper right duct segment two lobes to the right of the guide pin on the mixer. See Figure 206 (Sheet 2).

E. Installation (Other Than Boeing 737 LGW)

CAUTION: IF THE ENGINE IS FOR A BOEING 727, BE SURE THE MIXER DUCT ASSEMBLY IS THE CORRECT PART NUMBER FOR THE AIRCRAFT ENGINE POSITION (THE PART NUMBER FOR POD INSTALLATIONS IS NOT THE SAME AS THAT FOR THE CENTER POSITION). INCORRECT DUCT INSTALLATION CAN CAUSE ENGINE PERFORMANCE PROBLEMS AND POSSIBLE ENGINE DAMAGE.

NOTE: Mixer may be installed as an assembled unit or as a partially assembled unit depending on degree of difficulty encountered at installation.

NOTE: Refer to paragraph F. for mixer installation procedures applicable to Boeing LGW installations.

(1) Installation of completely assembled mixer. See Figure 205.

(a) Locate group of three holes close together on flange of fan and turbine exhaust duct. Mark center hole.

(b) Locate group of three holes close together on flange of duct outer exhaust case flange at 12 o'clock position. Mark center hole.

(c) Visually inspect turbine exhaust case rear rail to turbine exhaust case fairing interface to determine presence of approximately 0.125 inch clearance. See Figure 205.

(d) Using hoist and sling position mixer to turbine exhaust case aligning previously marked holes on guide and turbine exhaust case.

(e) Push mixer assembly forward while guiding leading edges of duct segments between turbine exhaust case fairing and turbine exhaust case rear rail.

(f) If resistance is encountered check following locations:

1 Duct segment leading edge abutting trailing edge of turbine exhaust case fairing (Index 8, Figure 205).

a Starting in an area where clearance is available, work shim stock, or similar material, around circumference to guide duct segments into place.

2 Duct segment leading edge abutting rear face of turbine exhaust case rail, Figure 205, Index 6.

a Starting in an area where the duct segments are in good alignment, rock mixer assembly in a circular motion while pushing forward. Do not use excessive force as deformation of segment leading edge could occur. If deformation does occur, pull mixer back and correct as required.

3 If mixer assembly does not move into place, loosen three screws at each of mixer segments overlap joints. This will allow some flexibility in segments.

a Loosening of remaining 24 segment screws will increase amount of segment flexibility.

b Retighten all segment screws loosened in preceding steps.

NOTE: To get the maximum clearance between the duct segment rear edges and the mixer, push the duct segments forward before the screws are torqued.

4 Mixer duct leading edge abutting trailing edge of guide Figure 205, Index 1.

a Starting in an area where clearance is available, use rocking motion and work leading edge of duct into guide.

(g) Install four screws (heads rearward), washers (under nuts) and nuts to countersunk screw holes in guide flange. Torque screws.

(h) Using lights and mirrors, as required, inspect completed assembly to ensure correct insertion and overlap of mating duct segments, turbine exhaust case fairings, and guides.

(2) Installation of partially assembled mixer. See Figure 205.

(a) If preceding installation procedures in step (1) cannot be used or proves to be difficult due to minimal clearances proceed as follows:

1 Remove all duct segments held by 33 screws.

2 Insert leading edge of duct segments between turbine exhaust case fairing and turbine exhaust case rail. Locate segments in same angular relationship to top centerline as they were when removed from mixer duct assembly.

3 Restrain segments rear edges in radially outward position to permit clearance with mixer duct assembly at installation.

4 Mark location holes as specified in step (1)(a) and (1)(b) above.

CAUTION: SPREAD DUCT SEGMENTS ADEQUATELY TO CLEAR BRACKETS ON MIXER.

5 Position mixer duct assembly and guide onto turbine exhaust cases aligning marked holes on guide and turbine exhaust case.

6 Install four screws (heads rearward), washers (under nuts) and nuts to countersunk screw holes on guide flange. Torque screws.

7 Position duct segments to mixer duct assembly and reinstall 33 screws (assemblies post SB 6057 will have washers under the screws).

8 Using lights and mirrors, as applicable, confirm proper insertion and overlap of duct segments, turbine exhaust case fairings, and guides.

(3) For engines that are post SB 5846 or SB 5947 (Federal Express modification for decreased noise) install the outer fan exhaust duct (spacer case). Attach the spacer case to the outer fan exhaust duct assembly (Flange M) with bolts. See Figure 201.

NOTE: On pod engines, an airframe supplied "wedge ring" is installed between the spacer case and Flange M of the fan exhaust outer duct assembly. On these engines attach the wedge ring with bolts to the rear flange of the engine (Flange M).

F. Installation (Boeing 737 LGW)

(1) Look to be sure than there is an approximate 0.125 inch clearance between the turbine exhaust case rear rail and the turbine exhaust case fairing. See Figure 205.

(2) Lift the mixer assembly with a hoist and sling and put it in position at the rear of the engine. Make sure the slots in the duct segments are correctly aligned with the No. 6 bearing oil tubes and the EGT harness fairing.

NOTE: Align the mixer assembly with the engine as shown in Figure 206 (Sheet 1 or 2) for a left or right engine, as applicable. Put the "TDCLHS" and "TDCRHS" marks in the opposite positions for left and right side as shown in the figures. For a left engine, install the mixer with the "TDCRHS" mark on the guide at the top center position. For a right engine, install the mixer with the "TDCLHS" mark on the guide at the top center position.

(3) Push the mixer assembly forward and get the leading edges of the duct segments between the turbine exhaust fairing and the turbine exhaust case rear rail (see Figure 205).

(4) If the mixer does not go easily into position, look at these areas for blockage:

(a) If the duct segment leading edge is against the trailing edge of the turbine exhaust fairing: Start in an area where there is clearance available and push shim stock or other material around the circumference to get the duct segments into position.

(b) If the duct segment leading edge is against the rear face of the turbine exhaust case rail: Start in an area where the duct segments are well aligned and give the mixer a circular movement at the same time as the mixer is moved forward. Do not use too much force or deformation of the duct leading edge can occur. If deformation occurs, pull the mixer back and correct the deformation as necessary.

(c) If the mixer leading edge is against the trailing edge of the guide ring: Start in an area where clearance is available and give the mixer a circular movement to put the leading edge of the mixer in the guide ring.

(5) Attach the mixer to the outer fan duct at the 12 o'clock position with one screw (head to the rear in the countersunk hole in the guide), washer, and nut. Torque the screw.

(6) Tighten the 33 screws that attach the duct segments to the correct torque.

NOTE: The procedures above install the mixer, guide, and duct segments as an assembly. It is also possible (and permitted as an alternate procedure) to install the three duct segments in the gap at the turbine exhaust duct case rail, install the mixer and guide subassembly on the exhaust duct flange, and attach the duct segments to the mixer and guide subassembly.

Task 72-55-00-300-001:

2. Fan Exhaust Rear Duct Segment (Typical PN 774879, 5001080-01, 5001081-01, 810510-01, 810511-01)

A. Minor Surface Damage Blend Repair

(1) Repair minor nicks and scratches that have sharp edges or V-shaped grooves. Blend this damage smooth to a maximum depth of 0.010 inch. The area with blends must be gradual, from a minimum of 1.000 inch to a maximum of 3.000 inches on each side of a nick or scratch.

(2) It is permitted to repair cracks which begin in the corners of the area where the mixer duct segments are attached and are not longer than six inches, as follows:

(a) Stop-drill the cracks with a 0.125 inch drill.

(b) Continue the engine in service, but examine the duct again after 100 hours maximum. If a duct has cracks longer than eight inches, remove the mixer from service after no more than 10 hours.

(3) It is permitted to repair cracks adjacent to the mixer lobe boltholes if they are not more than three inches long, as follows:

(a) Stop-drill the cracks with a 0.125 inch drill.

(b) Continue the engine in service, but examine the mixer lobe again after 100 hours maximum. If the duct has cracks longer than five inches, remove the mixer from service after no more than 10 hours.

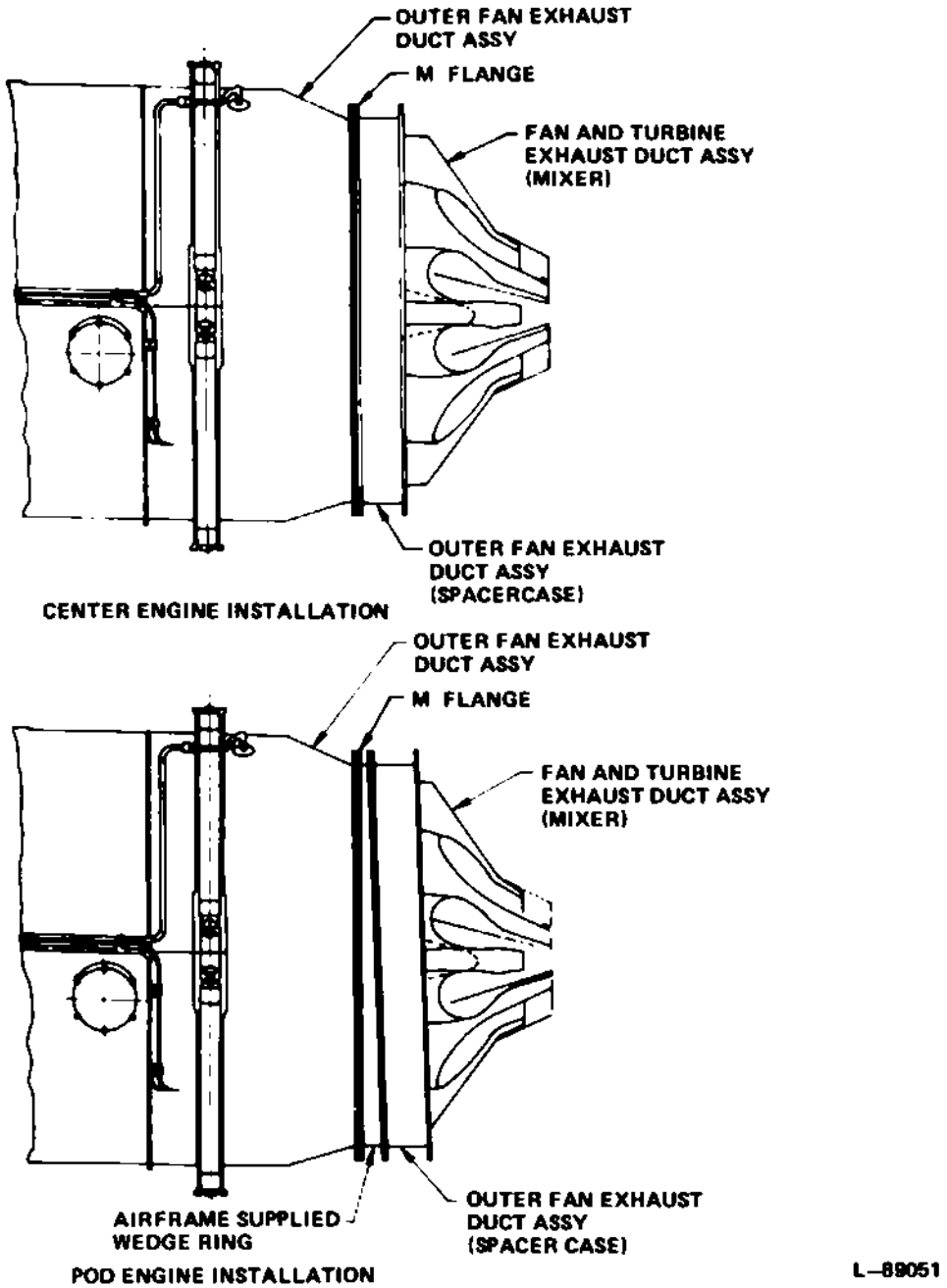
(4) If a duct segment has a piece broken free from the bolthole section rearward on lobes which are not adjacent, remove the mixer after no more than 10 hours maximum. If two adjacent lobes have pieces broken out, remove the mixer in two cycles maximum.

(5) Anodize touch-up all blended surfaces. See Section 70-00, Standard Practices Manual.

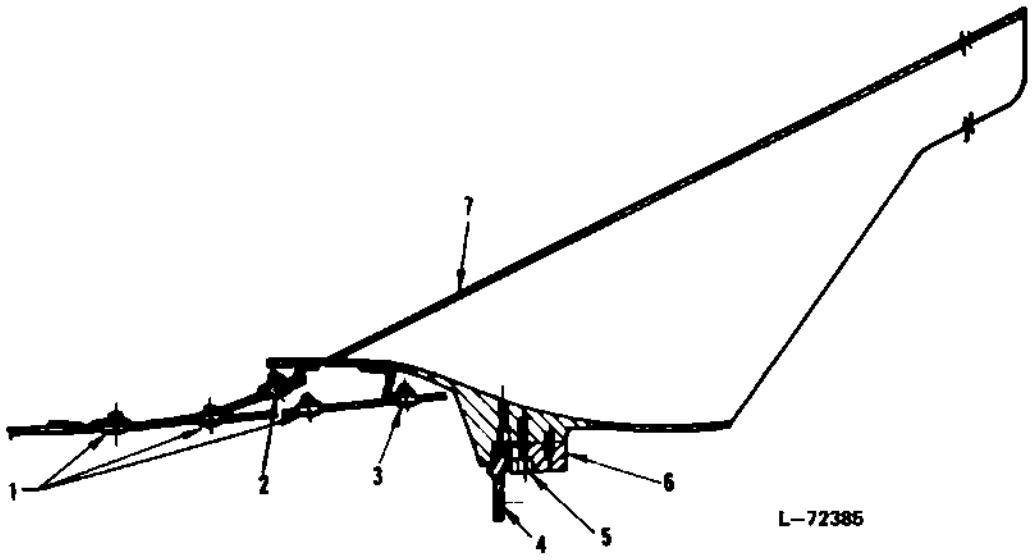
B. Trailing Edge Torn-Out Area Blend Repair
See Figure 207.

(1) Blend the edges or torn-out areas on the trailing edge to make a smooth profile with adjacent areas. This profile must be inside a three-inch radius along the trailing edge, and must not touch the mounting holes. See Figure 205.

(2) Anodize touch-up all blended surfaces. See Section 70-00, Standard Practices Manual.

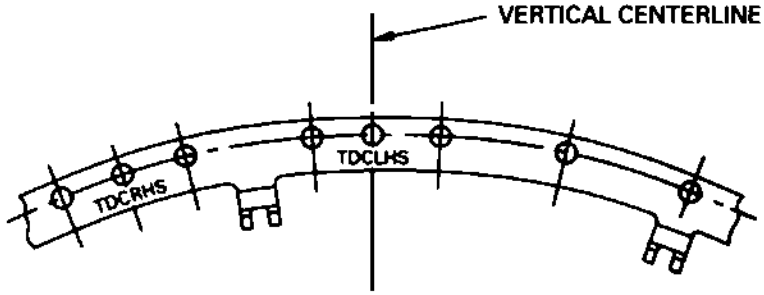

OUTER FAN EXHAUST DUCT ASSY
M FLANGE
FAN AND TURBINE EXHAUST DUCT ASSY (MIXER)
OUTER FAN EXHAUST DUCT ASSY (SPACERCASE)
CENTER ENGINE INSTALLATION
OUTER FAN EXHAUST DUCT ASSY
M FLANGE
FAN AND TURBINE EXHAUST DUCT ASSY (MIXER)
AIRFRAME SUPPLIED WEDGE RING
OUTER FAN EXHAUST DUCT ASSY (SPACER CASE)
POD ENGINE INSTALLATION
L-89051

SB 5846 Or SB 5947 Type
Exhaust Duct Parts
Figure 201
(Task 72-55-00-300-001)

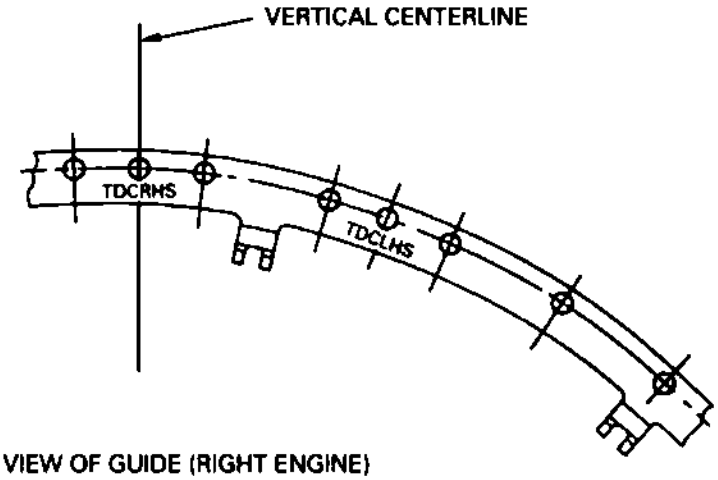


1. Overlap Screws
   (Post-SB 6057 Assemblies Have Washers Installed)
2. Screws Positioned Between Scallops
   (Post-SB 6057 Assemblies Have Washers Installed)
3. Screws At Scallop Locations
   (Post-SB 6057 Assemblies Have Washers Installed)
4. Guide
5. Bolts
6. Fairing
7. Duct

Fan And Turbine Exhaust
(Mixer) - Disassembly/Assembly
Figure 202
(Task 72-55-00-300-001)



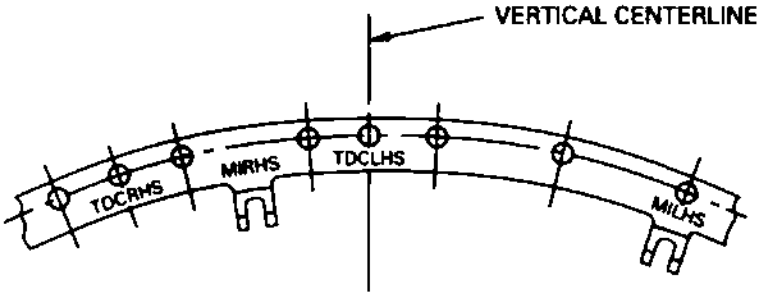
REAR VIEW OF GUIDE (LEFT ENGINE)



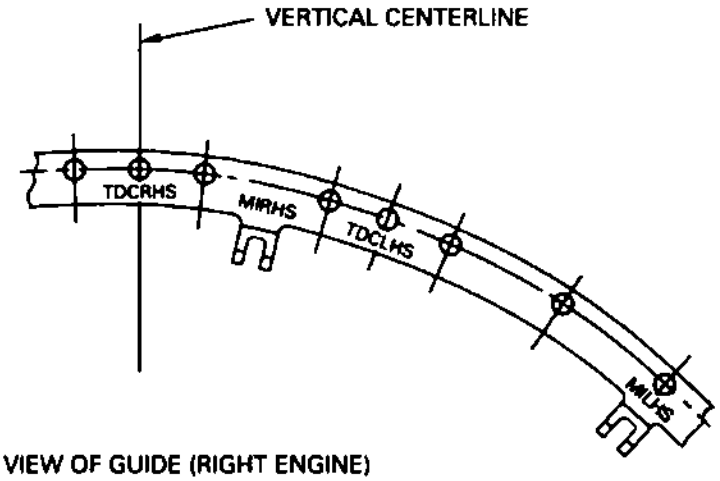
REAR VIEW OF GUIDE (RIGHT ENGINE)

L-H1849 (0000)

Post-SB 5947 Boeing 737
Mixer Guide Alignment
Figure 203 (Sheet 1)
(Task 72-55-00-300-001)



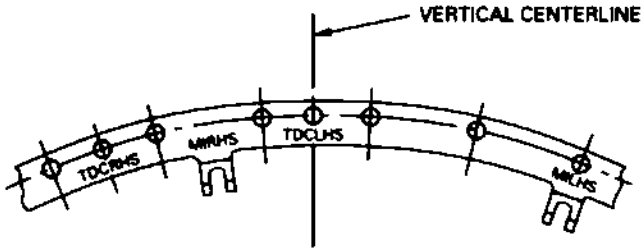
REAR VIEW OF GUIDE (LEFT ENGINE)



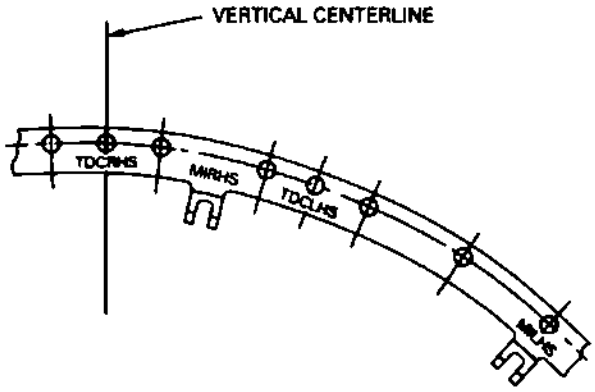
REAR VIEW OF GUIDE (RIGHT ENGINE)

L-H2219 (0000)

Post-SB 5947 Boeing 737 Mixer
Guide Alignment (PN 812024)
Figure 203 (Sheet 2)
(Task 72-55-00-300-001)



REAR VIEW OF GUIDE (RIGHT ENGINE)

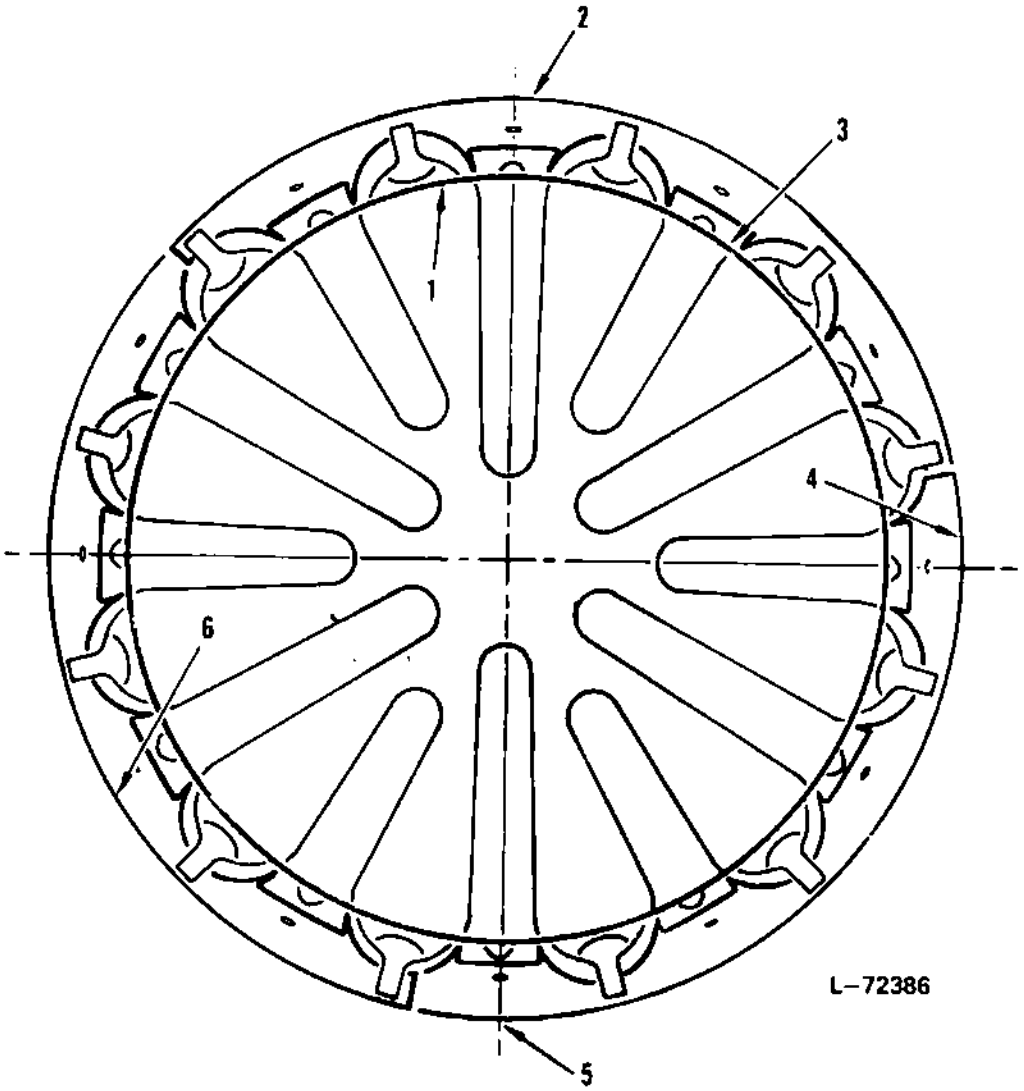


REAR VIEW OF GUIDE (LEFT ENGINE)

NOTE: FOR 737-LGW CONFIGURATION
THE RIGHT AND LEFT POSITIONS
ARE REVERSED AS SHOWN.

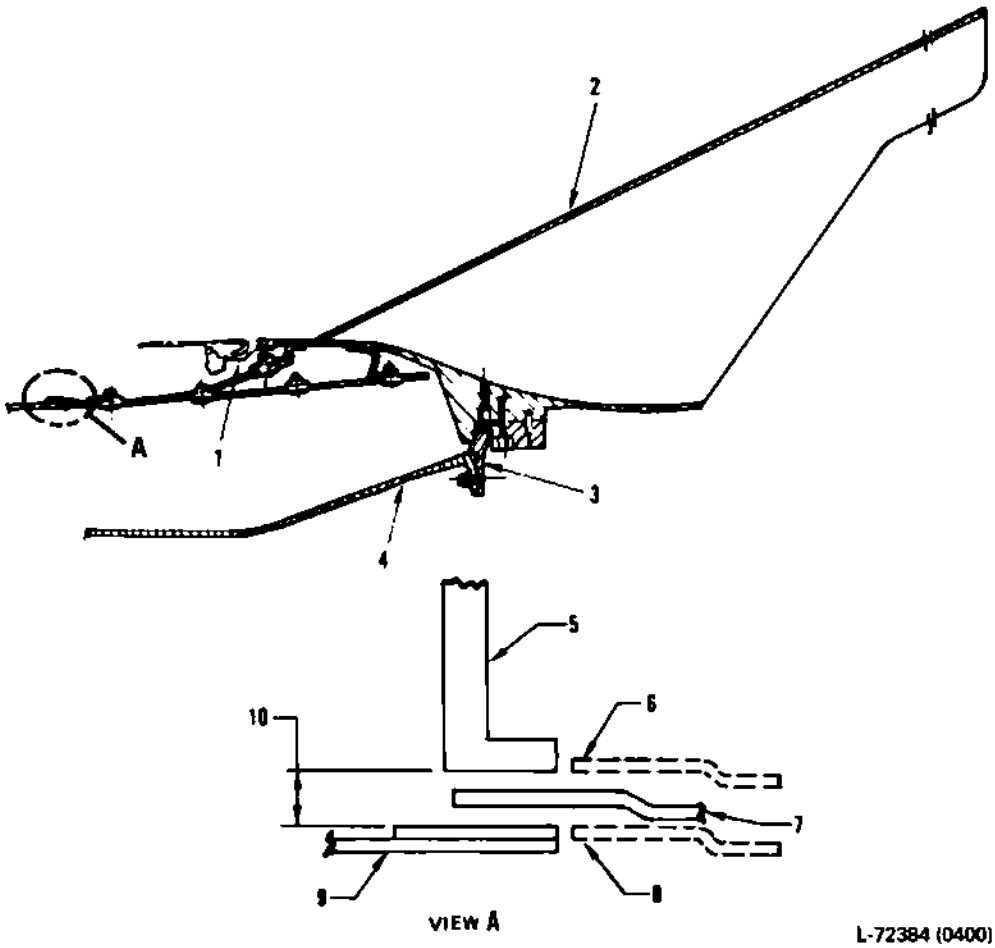
L-H4363 (0800)

Post-SB 5947 Boeing 737 Mixer
Guide Alignment (LGW Installation)
Figure 203 (Sheet 3)
(Task 72-55-00-300-001)



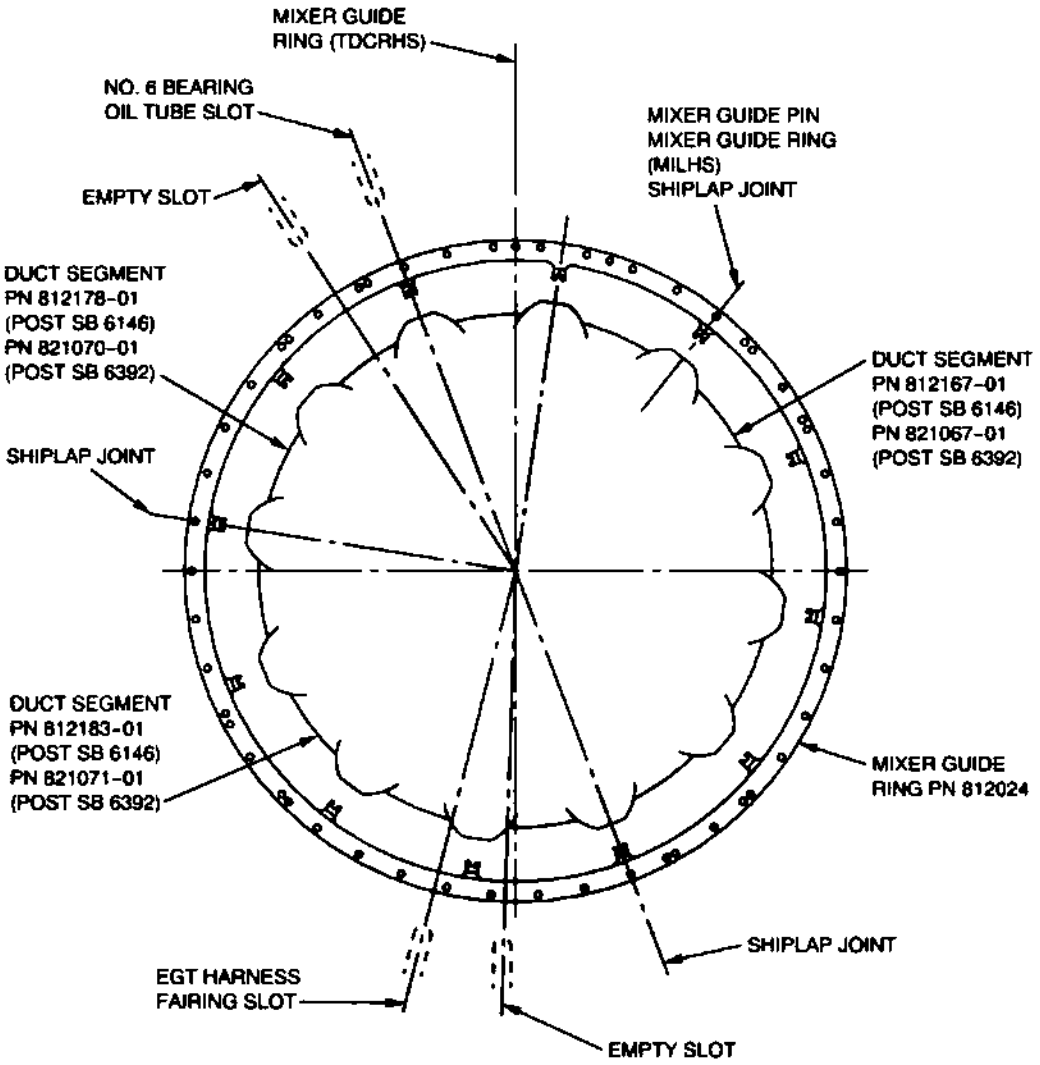
1. Dowel Pin Boss
2. Upper Rear Duct Segment (PN 5001080-01, 810510-01, 812178-01, Or 821070-01)
3. Fan And Turbine Exhaust Duct
4. Right Rear Duct Segment (PN 774879, 812167-01, Or 821067-01)
5. Vertical Centerline
6. Lower Rear Duct Segment (PN 5001081-01, 810511-01, 812183-01, Or 821071-01)

Fan And Turbine Exhaust
(Mixer) - Duct Assembly
Figure 204
(Task 72-55-00-300-001)



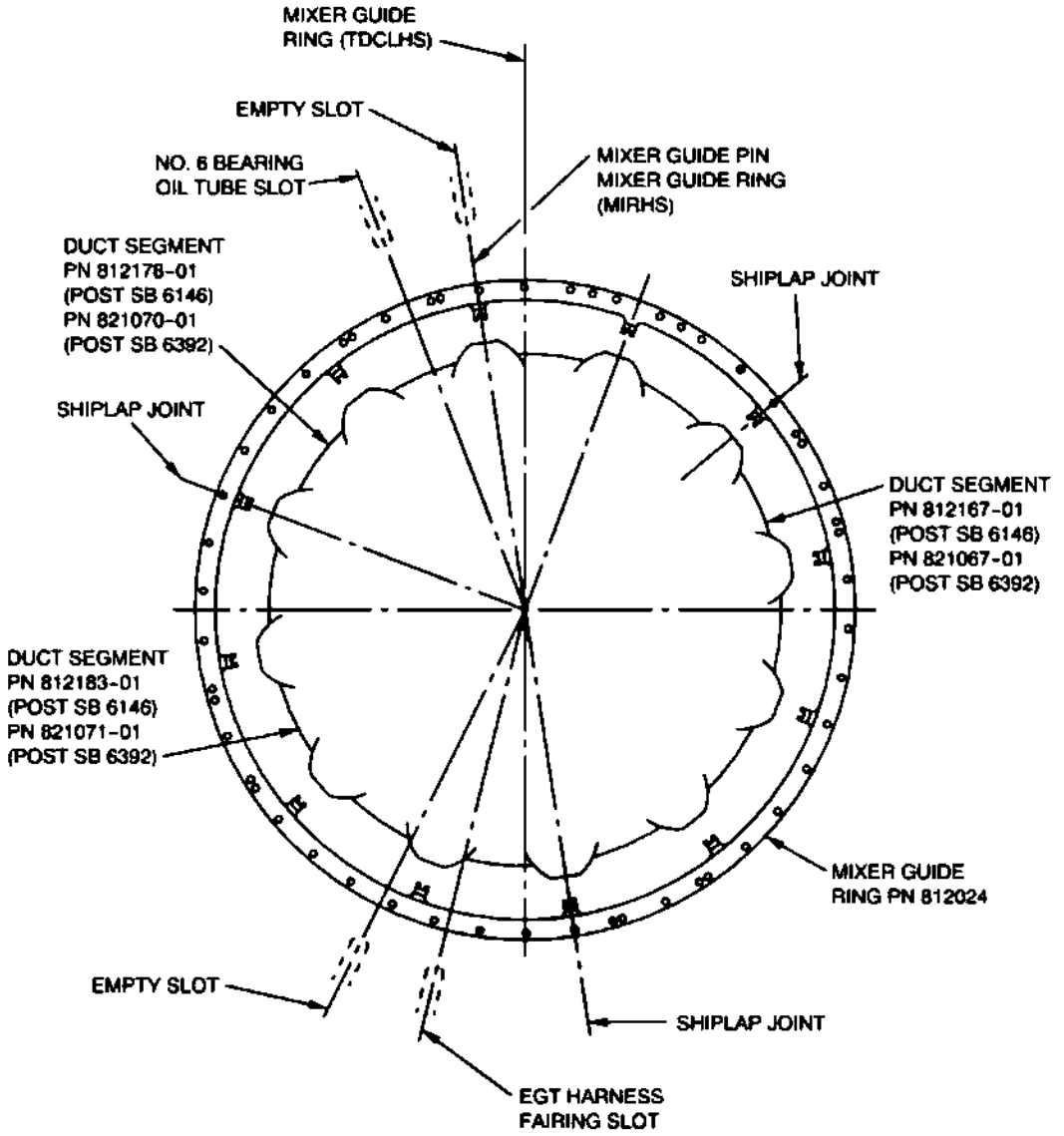
1. Guide Ring
2. Duct
3. Guide
4. Fan Exhaust Duct
5. Exhaust Case Rail
6. Interference
7. Duct Segment
8. Interference
9. Turbine Exhaust Case Fairing
10. Nominal 0.125 (3.175 mm) Clearance

Fan And Turbine Exhaust
(Mixer) - Installation
Figure 205
(Task 72-55-00-300-001)

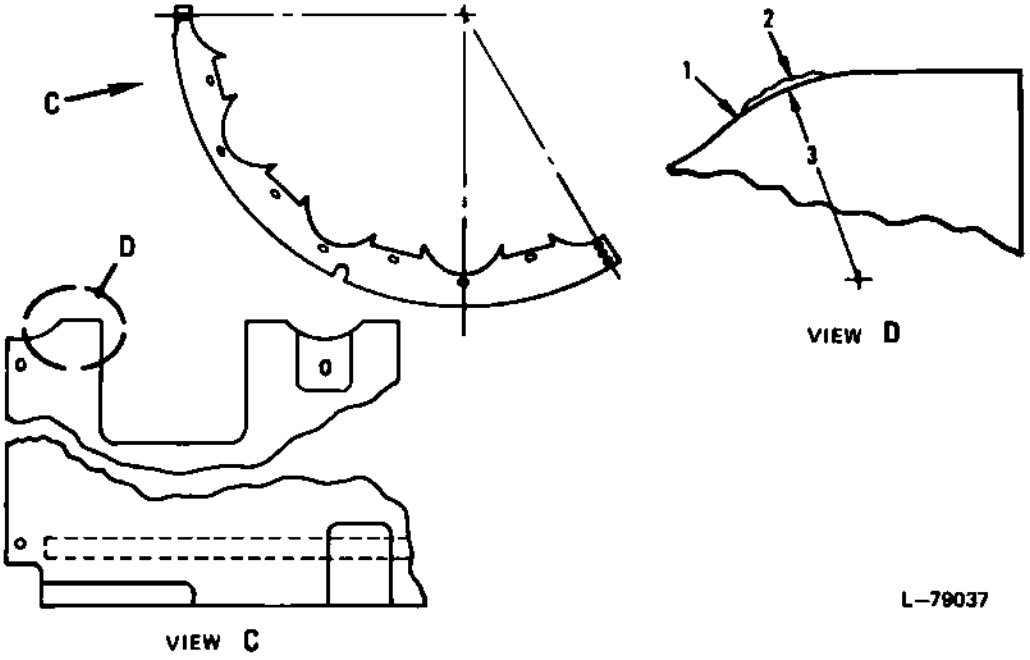

MIXER GUIDE RING (TDCRHS)
NO. 6 BEARING OIL TUBE SLOT
EMPTY SLOT
MIXER GUIDE PIN MIXER GUIDE RING (MILHS) SHIPLAP JOINT
DUCT SEGMENT PN 812178-01 (POST SB 6146) PN 821070-01 (POST SB 6392)
SHIPLAP JOINT
DUCT SEGMENT PN 812167-01 (POST SB 6146) PN 821067-01 (POST SB 6392)
DUCT SEGMENT PN 812183-01 (POST SB 6146) PN 821071-01 (POST SB 6392)
MIXER GUIDE RING PN 812024
SHIPLAP JOINT
EGT HARNESS FAIRING SLOT
EMPTY SLOT

L-H4361 (0101)
PW V

Boeing 737 (LGW) Mixer
Installation (Left Engine)
Figure 206 (Sheet 1)
(Task 72-55-00-300-001)


MIXER GUIDE RING (TDC/LHS)
EMPTY SLOT
NO. 6 BEARING OIL TUBE SLOT
MIXER GUIDE PIN MIXER GUIDE RING (MIRHS)
DUCT SEGMENT PN 812178-01 (POST SB 6146) PN 821070-01 (POST SB 6392)
SHIPLAP JOINT
SHIPLAP JOINT
DUCT SEGMENT PN 812167-01 (POST SB 6146) PN 821067-01 (POST SB 6392)
DUCT SEGMENT PN 812183-01 (POST SB 6146) PN 821071-01 (POST SB 6392)
MIXER GUIDE RING PN 812024
EMPTY SLOT
SHIPLAP JOINT
EGT HARNESS FAIRING SLOT
L-H4362 (0101)
PW V

Boeing 737 (LGW) Mixer
Installation (Right Engine)
Figure 206 (Sheet 2)
(Task 72-55-00-300-001)



1. Blend Profile
2. Tearout Area
3. Three Inch Maximum Blend Radius

Fan Exhaust Rear Duct Segment
Trailing Edge Blend Repair
Figure 207
(Task 72-55-00-300-001)

ACCESSORY AND COMPONENT DRIVES GEARBOX
HOUSING SECTION - DESCRIPTION-00

Task 72-60-00-990-003:

1. Accessory and Component Drives Gearbox Assembly

R See Figure 1 and Figure 2.

R A. General

R (1) The accessory and component drives gearbox assembly
R (accessory drives gearbox) consists of the gearbox
R housing, the gearbox rear housing, and the internal
R gears and shaftgears.

R (2) The gearbox assembly is mounted beneath the engine,
R secured to the fan discharge intermediate case flanges
R and, at the front, to Flange E. Power is supplied to
R the gearbox from a bevel gear splined to the front of
R the rear compressor drive turbine rotor shaft.

R (3) An oil pump assembly is located in the bottom of the
R gearbox, left of center, and contains both pressure and
R scavenge sections. The gearbox incorporates pinned
R carburized bearing liners except for the tower shaft
R drive gear roller bearings liners which are retained by
R bolts.

R B. Gearbox Drive Ratios

R (1) Refer to Figure 2 for a schematic of the gearbox
R internal drives. The rear compressor drive of the
R engine (N2) drives the accessory section through the
R towershaft as shown. The numbers of gear teeth are
R shown, as is the ratio of each drive in relation to N2.

Task 72-60-00-990-004:

2. Gearbox Protective Coating

A. Gearbox assemblies are painted in two ways. Early models are painted with gray lacquer; subsequent models are sprayed with the recommended aluminized epoxy paint, silver in color.

Task 72-60-00-990-005:

3. Accessory and Components Drives Gearbox Rear Housing

A. On the rear face of the gearbox rear housing there is a starter drive pad on the left, a 10 inch constant speed drive (CSD) and alternator drive pad in the center, and a hydraulic pump drive pad on the right. On the right end of the gearbox housing is a standard four stud pad for the N2 tachometer drive.

B. Near the bottom of the housing, to the left of the oil pump, is an oil pressure relief valve. The main oil strainer is located to the left of the oil pressure relief valve. An oil strainer bypass valve is located in the center of the main oil strainer assembly. An integral boss is provided on the side of the main oil strainer boss to accommodate the airframe manufacturer's oil filter bypass pressure warning switch.

C. Mounted on the starter drive gearshaft are two rotary
R breather impellers, used to separate oil from air. See
R Figure 3. A replaceable spline adapter is splined inside the starter drive gearshaft and held in place with a locknut and anchor bolt. The constant speed drive incorporates a replaceable splined coupling inside the gearshaft.

Task 72-60-00-990-006:

4. Accessory and Component Drives Gearbox Front (Cover) Housing

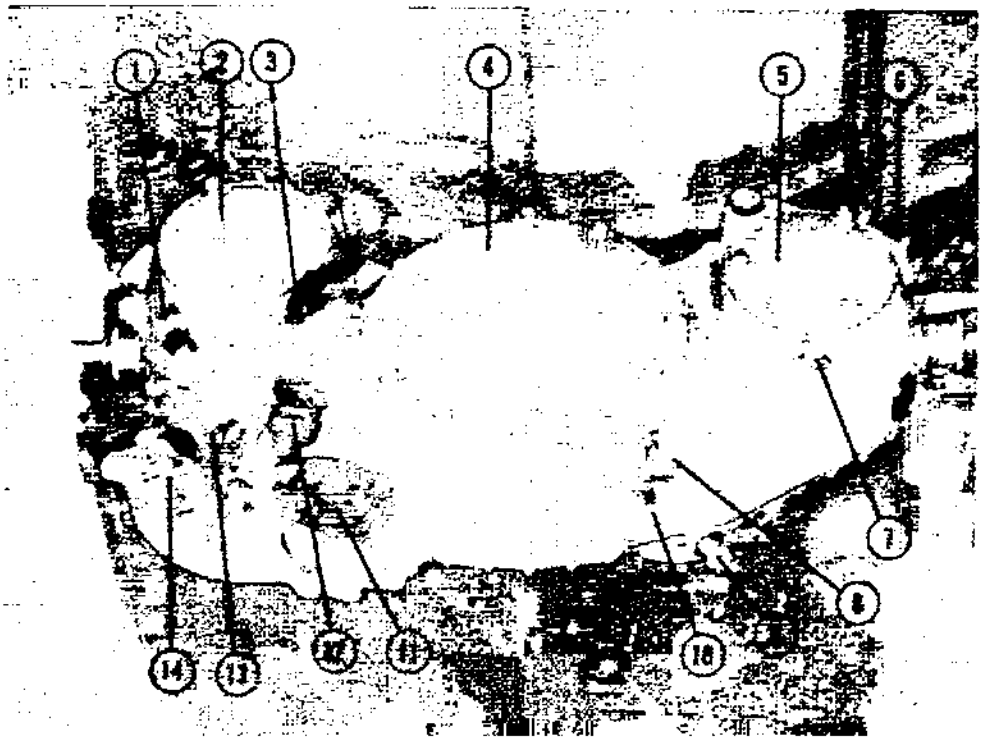
A. The engine fuel pump mounts on a six studded circular pad on the right front face of the main gearbox cover and the fuel control mounts on the front of the fuel pump. The oil tank mounts on the left front face of the gearbox front housing.

Task 72-60-00-990-007:

5. Power Lever Cross Shafts and Linkage

A. A power lever outer cross shaft assembly, which is hollow and has an inner shaft running through it, is mounted in bushings at the top of the gearbox housing cover. The fuel control power linkage arm is secured on the outer shaft at the right and, further outboard, the fuel control shutoff arm is held securely on the inner shaft. A stop and locking plate are mounted on the housing. The airframe control arms or pulleys may be mounted on either end of the cross shafts.
R

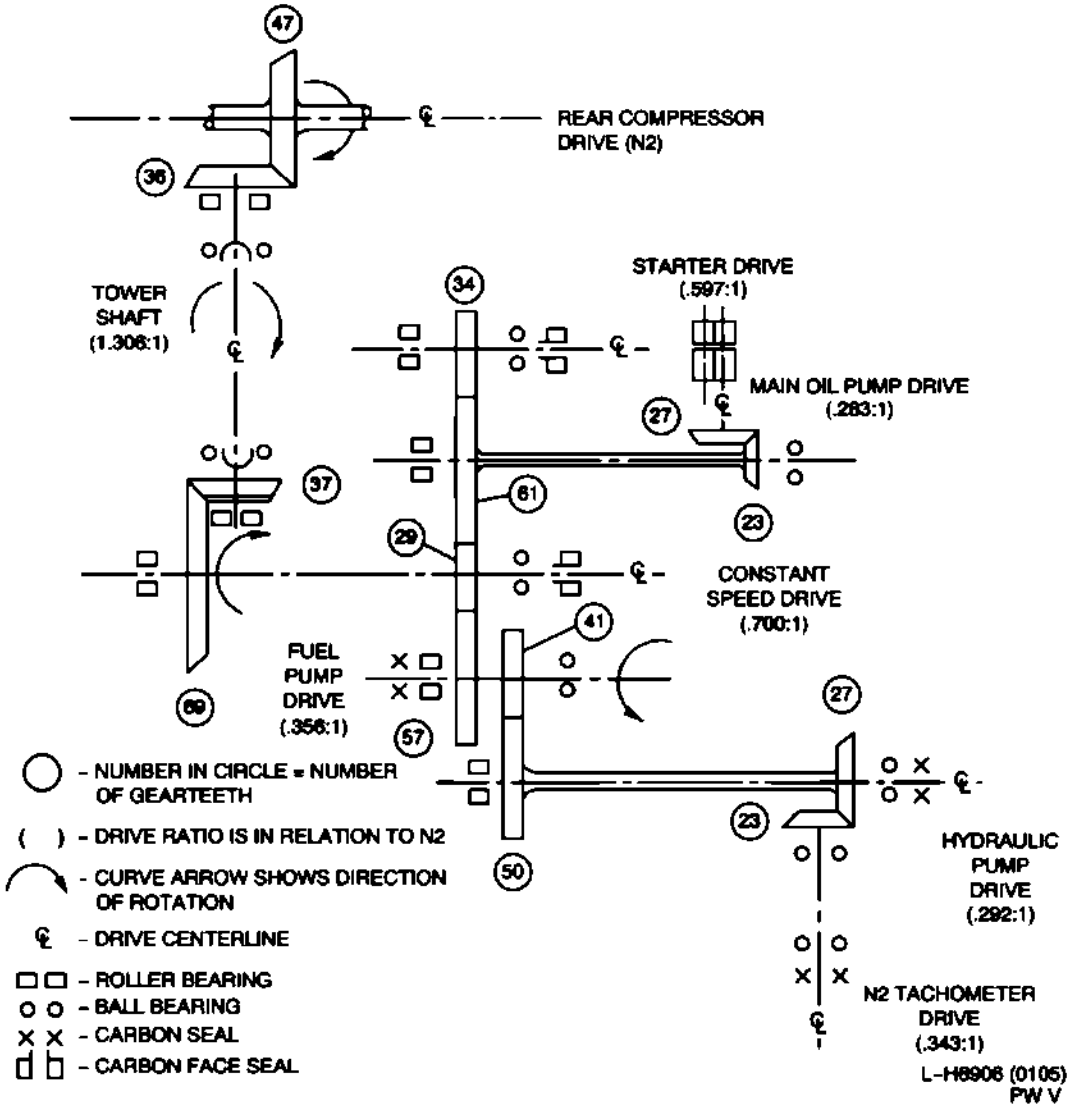
ACCESSORY AND COMPONENT DRIVES GEARBOX
HOUSING SECTION - DESCRIPTION-00



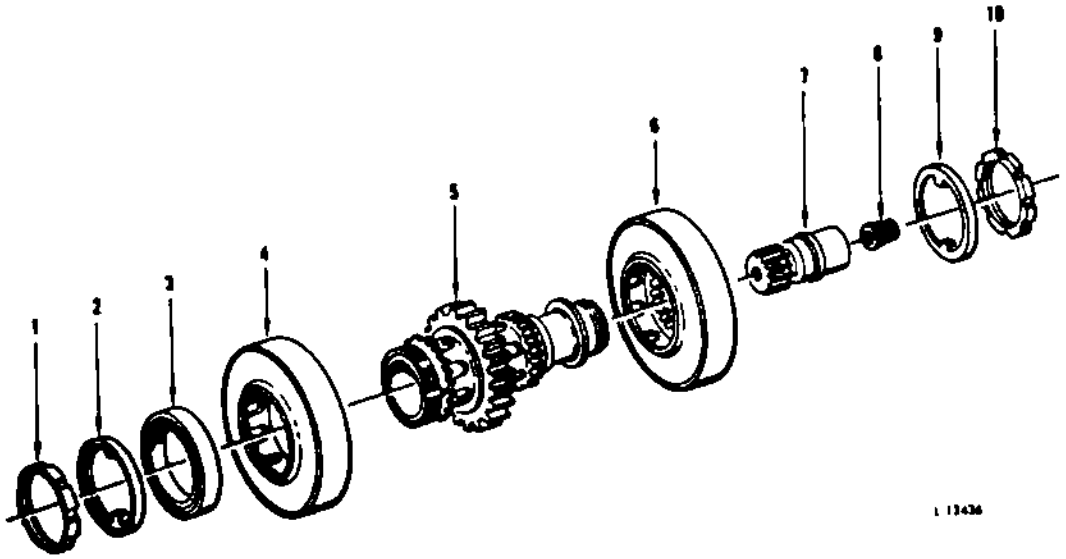
L-H4802 (0000)

1. Drain
2. Starter Drive Pad
3. Oil Cooler to Relief Valve Tube (Oil Pressure Signal)
4. Constant Speed Drive Alternator Mounting Pad
5. Hydraulic Pump Mounting Pad
6. N2 Tachometer Drive Pad
7. Drain
8. Drain
9. Drain
10. Gearbox Main Oil Drain
11. Main Oil Pump
12. Oil Pressure Regulating Valve
13. Oil Strainer
14. Overboard Breather Mounting Pad

Accessory and Component
R Drives Gearbox
R Figure 1
(Task 72-60-00-990-007)



R Gearbox Drive Ratios
R Figure 2
R (Task 72-60-00-990-007)



1. Retaining Nut
2. Keywasher
3. Bearing
4. Impeller
5. Gearshaft - Starter Drive
6. Impeller
7. Adapter - Spline
8. Locknut
9. Keywasher
10. Nut

R Rotary Breather Impellers
R Figure 3
(Task 72-60-00-990-007)

EFF: -ALL

ACCESSORY AND COMPONENT DRIVES GEARBOX
HOUSING SECTION - REMOVAL/INSTALLATION-00

Task 72-60-00-990-001:

1. General See Engine - Removal/Installation for general maintenance procedures

NOTE: Except where noted, all references to fits and clearances in this section refer to Inspection/Check-02.

Task 72-60-00-420-001:

2. Removal/Installation of Accessory Drives Gearbox

A. Removal

(1) Remove any external lines connected to accessories mounted on starter drive, constant speed drive, and hydraulic pump drive pads of accessory drives gearbox. Remove accessories from pads. Do not remove fuel pump and control.

CAUTION: WHEN THE GEARBOX MODULE TO BE REMOVED HAS THE FUEL CONTROL, FUEL PUMP, FUEL HEATER, GENERATOR AND CONSTANT SPEED DRIVE INSTALLED, PWA 46413 AND PWA 46414 LIFTING BRACKETS MUST BE USED.

CAUTION: DAMAGE WILL RESULT, IF THE REPLACED BRACKETS (PWA 16566 AND PWA 16567) ARE USED TO REMOVE THE ABOVE CONFIGURED GEARBOX MODULE.

(2) Secure PWA 46413 Bracket (formerly PWA 16566) to the starter drive pad and PWA 46414 Bracket (formerly PWA 16567) to the hydraulic pump drive pad so that bracket arms point forward. Put bracket spools on forward holes of bracket arms (if gearbox has generator and constant speed drive installed, use rear holes in bracket arms).

(3) Remove oil tank from gearbox. See Section 79-11-01.

(4) Drain the oil from the gearbox (optional).

NOTE: It is possible to drain the oil from the gearbox before the gearbox is removed from the engine (this will decrease the weight of the assembly and prevent oil leakage, and make inspection of the oil at this time possible).

(a) Get a clean container which can hold two gallons. A container of Nalgene HPDE (a high-density polyethylene) is recommended.

(b) Remove the gearbox drain plug.

(c) Drain the oil into the container.

(d) Temporarily install the drain plug back in the gearbox.

(5) Remove external air, oil, and fuel lines connected to fuel control, fuel pump, and gearbox.

(6) Position dolly under gearbox.

(7) Loosen and remove bolts, washers, and locknuts securing gearbox to engine.

CAUTION: THE GEARBOX AND RELATED ACCESSORIES, WHEN SUPPORTED BY SLING AND HOIST, MAY TEND TO PIVOT ON BRACKET SPOOLS. SUPPORT GEARBOX BY HAND AT A THIRD POINT TO PREVENT POSSIBLE ROTATION OF GEARBOX ABOUT BRACKET SPOOLS.

(8) Carefully lower gearbox onto dolly, holding accessory driveshaft until gearbox is clear of engine. Remove shaft and wrap in protective paper.

(9) Slide dolly from beneath engine.

(10) Remove pressure oil transfer tube.

NOTE: Transfer tube may remain in engine or may come with gearbox.

(11) If necessary, remove generator and constant speed drive from gearbox pad.

(12) If generator/CSD is removed, attach PWA 16177 Support to ten inch center pad.

NOTE: Gearbox Sling (PWA 7356) may be used in gearbox handling as a convenience tool.

(13) Install gearbox in PWA 16514 Stand, and secure with ball lockpin.

B. Gearbox Mount Bolts Washer Fitting (Gearboxes Not Yet Incorporating SB 1122)
See Figure 401.

(1) Fabricate spacer, as indicated in Figure 401 to simulate combined thickness of compressor intermediate case lugs plug flanges of bushings located in lug hole.

(2) Locate spacer between gearbox mount lugs and assemble bolts, washers, and nut. Torque nut to Fits and Clearances, Reference No. 1460 and secure.

(3) Check axial clearance with feeler gage.

(4) Machine smaller end face of washer to provide bolt end float of 0.003 - 0.005 inch.

NOTE: Float to be used in conjunction with spacer only and takes into account plus or minus 0.001 inch tolerance for bushing and lug combined thickness.

(5) Serialize both bolts and both washers with serial number of gearbox assembly. Mark one bolt and one washer "Right" and one bolt and one washer "Left".

(6) Remove bolts, washers, spacers, and nut.

C. Installation
See Figures 402 through 405.

NOTE: If original gearbox is being replaced with new gearbox, retain original data plate and attach to new gearbox.

(1) Install driveshaft in six o'clock strut of fan discharge intermediate case.

NOTE: Tube PN 480995, 511860 or 587649 must be used with Gearbox Rear Housings PN's 493188, 499806, 504889 or 515366.

(2) Install new packings at each end of pressure oil transfer tube. Install tube in six o'clock strut of fan discharge intermediate case. See Figure 402 (Sheet 1).

(3) Secure PWA 46413 Bracket (formerly PWA 16566) to the starter drive pad and PWA 46414 Bracket (formerly PWA 16567) to the hydraulic pump drive pad so that arms point toward fuel pump and control. Put bracket spools on outer holes of bracket arms (if gearbox has generator and constant speed drive installed, use inner holes in bracket arms).

(4) Disengage ball lockpin and raise gearbox, pump, and control from PWA 16514 Stand.

(5) Remove PWA 16177 Support from ten inch center mount pad.

(6) Lower gearbox in flight position onto dolly. Install new packings (one or two as required), lubricated with a thin layer of PWA 36500 Assembly Fluid, in grooves of gearbox to fan discharge intermediate case mating flange (on gearbox). See Figure 402 (Sheet 1).

CAUTION: FOR ENGINES PRIOR TO SB 2338, INSTALL PN 565716 PACKING IN BOSS WITH GROOVE WIDTH OF 0.145 INCH. INSTALL PN 440615 PACKING IN BOSS WITH GROOVE WIDTH LESS THAN 0.145 INCH. FOR ENGINES INCORPORATING SB 2338, INSTALL SINGLE PN 615697 PENTAGONAL PACKING.

(7) Position gearbox under six o'clock strut of intermediate case.

(8) Install 14 inch length of flexible plastic tube small enough in diameter to slip easily into gearbox oil pressure tube.

(9) Carefully raise gearbox so that driveshaft mates with gearbox driveshaft adapter, oil pressure tube locates in gearbox passage (aligned by plastic tube inserted into oil tube), and gearbox mount flanges properly contact engine mount bracket and bushings.

(10) Remove flexible plastic tube.

(11) Gearbox Positioning Lugs.

(a) Position gearbox left and right positioning lug on top of gearbox rear housing and install two bolts fingertight.

(12) Install gearbox mounting pins and bolt as follows. (For engines with right angle mounting lugs) See Figure 402 (Sheet 2).

(a) Prior to securing gearbox to engine, check pin clearances in gearbox lugs and compressor case mounting brackets according to Inspection/Check-02, Reference number 1160 and 1161.

(b) Position gearbox rear mount lugs in compressor case mounting brackets, and insert mounting pins. Secure pins in place with lock plates and secure plates with bolts. Secure with lockwire bolts. See Figure 403.

(c) Install bolt, washer, and nut to secure front mount arm to bracket(s). For engines with three piece mount brackets, dimensionally check as shown in Figure 404. Use PWA 521 engine oil on threads. Torque nut as specified in Inspection/Check-00, Reference Number 1460 and secure with cotterpin.

(d) Adjust gearbox position lugs to Inspection/Check-02 Reference Number 1157 and 1158. See Figure 403. Torque and lockwire bolts, securing positioning lugs.

(e) Install bolt, washer, and nut to secure front mount arm to bracket.

(13) Install gearbox mounting bolts (for engines with axial mounting bolts and incorporating SB 1122). See Figure 405.

(a) Insert bolt through tablock, lug bushings, and pin bar at each lug location.

(b) Measure for gap shown in referenced figure. If gap is not obtained, machine or select new pin to obtain gap.

NOTE: When it is necessary to machine pin, remove equal amounts of stock from each side. Ends of new pins must be free to move laterally inside brackets.

(c) Install washer and nut. Torque to 250 to 350 pound-inches, using engine oil (or equivalent) as thread lubricant. Secure cotterpin.

(d) Install bolt, washer, and nut to secure front mount arm to bracket(s). For engines with three piece mount brackets, dimensionally check as shown in Figure 404. Use engine oil (or equivalent) on threads. Torque nut as specified in Inspection/Check-02, Reference Number 1460 and secure with cotterpin.

(e) Adjust gearbox position lugs in accordance with Figure 403. Torque and lockwire bolts, securing positioning lugs.

(14) Install gearbox mounting bolts (for engines with axial mounting bolts but not incorporating SB 1122). See Figure 401.

(a) Install bolts and washers in their respective right and left positions. Use PWA 521 Engine Oil as a thread lubricant and tighten nut for each to torque as specified in Inspection/Check-02, Reference Number 1460.

CAUTION: SHOULDERED WASHER MUST BE FITTED FOR ITS INDIVIDUAL POSITION AND MUST BE MEASURED AT EACH INDIVIDUAL BOLT LOCATION.

(b) Check movement with dial indicator. Movement should be within the limit specified in Inspection/Check-00, Reference Number 1156 for engines so equipped.

(c) Install bolt, washer, and nut to secure front mount arm to bracket(s). For engines with three piece mount brackets, dimensionally check as shown in Figure 404. Use PWA 521 Engine Oil on threads. Torque nut as specified in Inspection/Check-02, Reference 1460 and secure with cotterpin.

(d) Adjust gearbox position lugs per Figure 403. Torque and lockwire bolts, securing position lugs.

(15) Remove brackets from gearbox.

(16) Install engine oil tank.

(17) Connect external fuel, air, and oil lines to fuel control, pump, and gearbox.

(18) Install accessories on starter drive, constant speed drive, and hydraulic pump drive pads. Connect external liners to accessories and secure.

D. Installed Gearbox Air Check

R (1) Connect PWA 12210 Adapter to the No. 2 and 3 bearing
R pressure oil elbow on the rear of the gearbox. Connect
R a pressure gage to the small fitting on the adapter
R and connect the adapter (with PWA 6507 Flowmeter) to a
R pressurized air source. Put 10 psi air pressure
R into the No. 2 and 3 bearing pressure oil line.
R Airflow through this line into the No. 2 and 3 bearing
R compartment must be 13 - 26 lbs. per hour.

(2) If greater, remove gearbox and recheck to make sure tubes and all packings are in place.

(3) Reinstall gearbox and repeat air check.

Task 72-60-00-423-001:

3. Removal/Installation of Connecting Linkage - Cross Shaft-to-Fuel Control

A. Removal

(1) Remove the cotterpins, bolts, nuts and washers which se- cure the links to the fuel control shutoff arm and the fuel control power arm.

(2) Remove the cotterpins, bolts, nuts and washers which secure the links to the fuel control levers and remove the connecting links.

B. Installation

(1) Position the connecting links and secure to the fuel control levers using the bolts, washers, nuts and cotterpins.

(2) Secure the links to the fuel control shutoff arm and the fuel control power arm using the bolts, washers, nuts and cotterpins.

C. Connecting Linkage Final Alignment Check

(1) Check alignment (after installing connecting linkage) in accordance with the following:

(a) Insert a 0.015 inch thick gage between fuel control shutoff lever and its stop when lever is rotated counterclockwise and insert a 0.246-0.248 inch diameter pin through the hole at the end of the cross shaft shutoff lever and into the holes of the gearbox mounted bracket.

(b) If necessary, loosen the nuts that hold the bracket to the gearbox and move the bracket within the clearance of the stud holes.

(c) If the pin will not fit into the bracket, then steps 1 through 4 in the following paragraph Shutoff Lever Linkage Adjustment must be repeated.

Task 72-60-00-430-002:

4. Installation and Adjustment of Connecting Linkage, Cross Shaft-to-Fuel Control

A. Power Lever Linkage Adjustment and Installation See Figure 406 which illustrates appearance of each link as installed, after proper adjustments have been made.

(1) Place fuel control power lever at idle index position.

(2) With fuel control power lever mounted, adjust PWA 12881 Power Lever Locator (PWA 33642 Locator for JT8D-17,-17A,-17R,-17AR) to fit power lever arm and inner cross shaft (fuel shutoff) arm. Position locator using center in cross shaft and fuel control power lever shaft, and linkage pin holes in arms.

(3) Secure locator screws to maintain position.

(4) Try PWA 12882 Index Pin in idle index positioning slot. If pin does not fit, remove fuel control and reset indexing.

(5) Remove locator and place on bench. Position and adjust connecting link and bearing assembly to longer pins of locator.

(6) Secure jamnut fingertight.

R
R

(7) Remove link assembly from locator and install on fuel control levers using bolts, washers, nuts, and cotterpins. Torque and lockwire jamnut. See Chapter/Section 72-00-00, Inspection/Check-02, External Parts, Reference 6 for end gap and proper bolt head position.

Task 72-60-00-430-003:

5. Shutoff Lever Linkage Adjustment and Installation

A. Procedure

(1) Before installing shutoff linkage assembly on fuel control, position and adjust PWA 12883 Shutoff Linkage Setting Gage (PWA 33643 Gage for JT8D-17,-17A,-17R and -17AR) so that pointed ends of pins fit center holes of fuel control lever shaft and engine cross shaft.

(2) Place set gage on bench and adjust linkage assembly to fit over pins of gage.

(3) Tighten jamnut fingertight.

(4) Install linkage assembly on engine using bolts, washers, nuts, and cotterpins. Torque and lockwire jamnut.

B. Connecting Linkage Final Alignment Check for Fuel Shutoff

(1) Check alignment (after installing connecting linkage) by installing PWA 12884 Alignment Pin in accordance with Figure 406.

Task 72-60-00-430-004:

6. Holding or Turning Rear Compressor Rotor With the Starter Removed From the Gearbox

A.

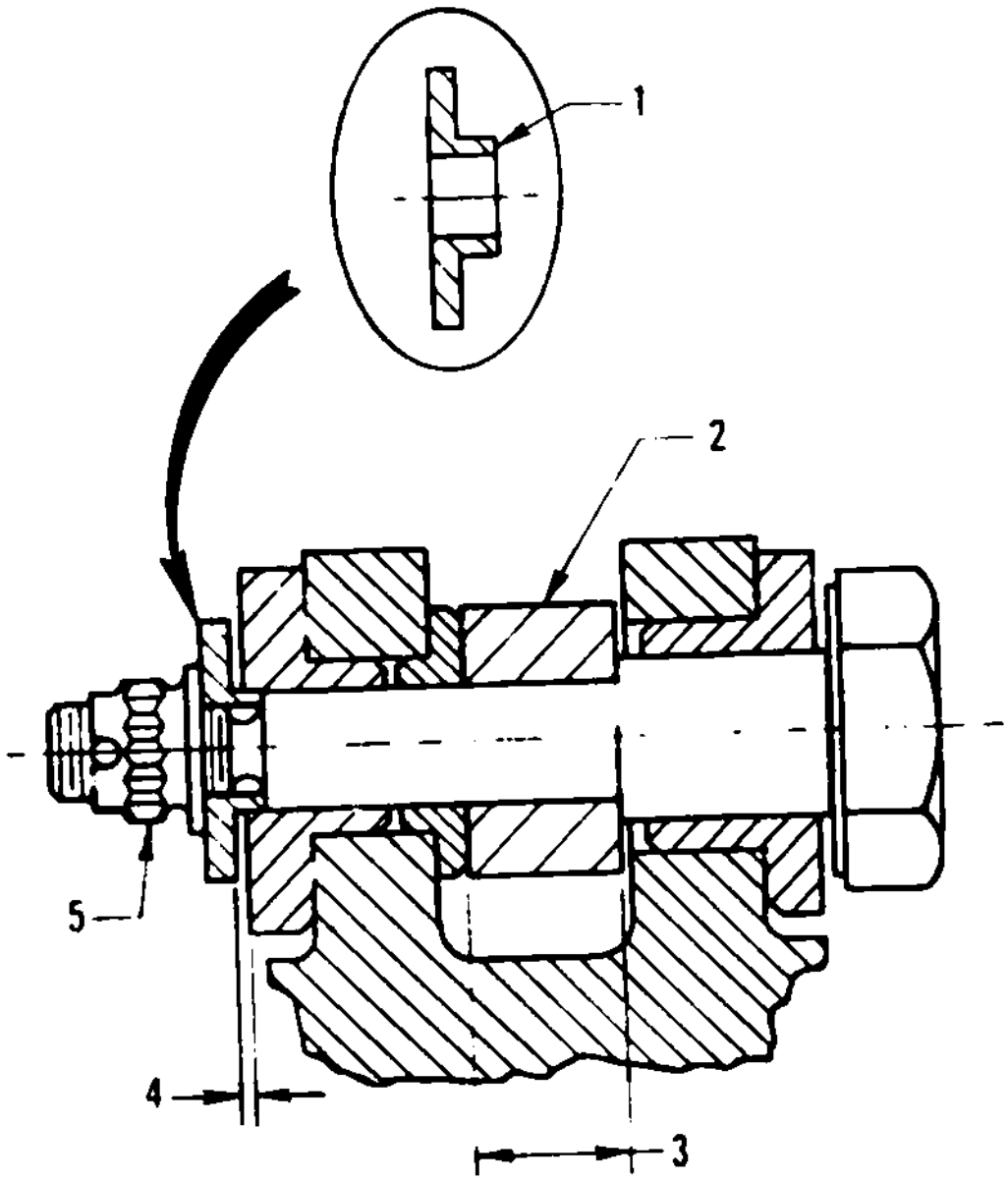
(1) The PWA 10408 Adapter may be used in the starter drive adapter splines to hold or turn the rear compressor rotor when the starter is removed from the gearbox.

Task 72-60-00-990-002:

7. Numerical Tool List

A.

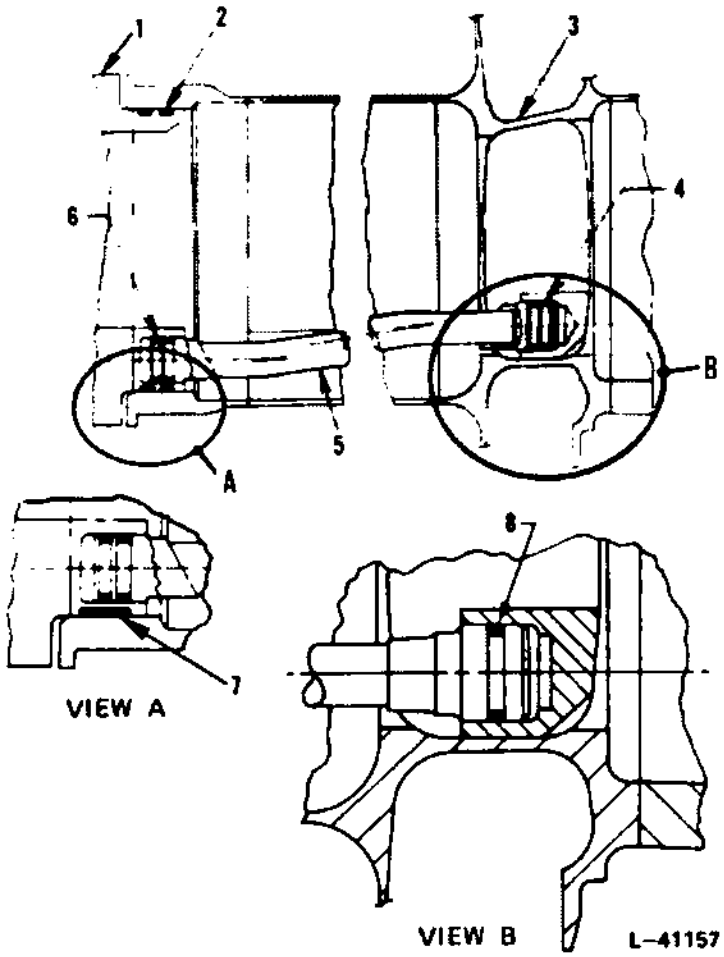
PWA 7356	Sling - Gearbox
PWA 12210	Adapter - Gearbox Air Check
PWA 12881	Locator - Power Lever (JT8D-1,-1A,-1B,-7,-7A,-7B, -9,-9A,-11,-15,-15A)
PWA 12882	Pin - Index
PWA 12883	Gage - Linkage Setting (JT8D-1,-1A,-1B,-7,-7A,-7B, -9,-9A,-11,-15,-15A)
PWA 12884	Pin - Alignment
PWA 16177	Support - Gearbox
PWA 16514	Stand - Gearbox
PWA 16566	Bracket - Gearbox Left (Replaced by PWA 46413)
PWA 16567	Bracket - Gearbox Right (Replaced by PWA 46414)
PWA 33642	Locator - Power Lever (JT8D-17,-17A,-17R,-17AR)
PWA 33643	Gage - Linkage Setting (JT8D-17,-17A,-17R,-17AR)
PWA 46413	Bracket - Gearbox, Lift and Trunnion (Replaces PWA 16566)
PWA 46414	Bracket - Gearbox, Lift and Trunnion (Replaces PWA 16567)



1. Machine This Face (Or Select Washer)
   To Obtain Index No. 4
2. Fabricate Spacer
3. 0.580 Inch Reference
4. 0.002 Inch To 0.006 Inch
5. Reference Number 1460

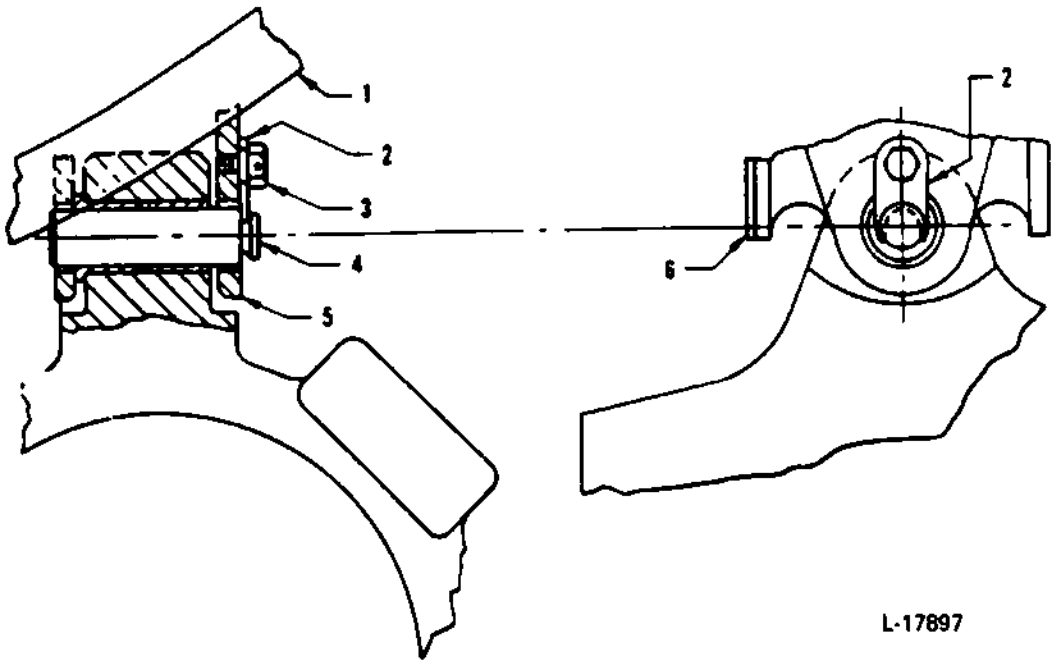
Axial Mount Gearbox Mount

Bolts Washer Fitting
Figure 401
(Task 72-60-00-990-002)



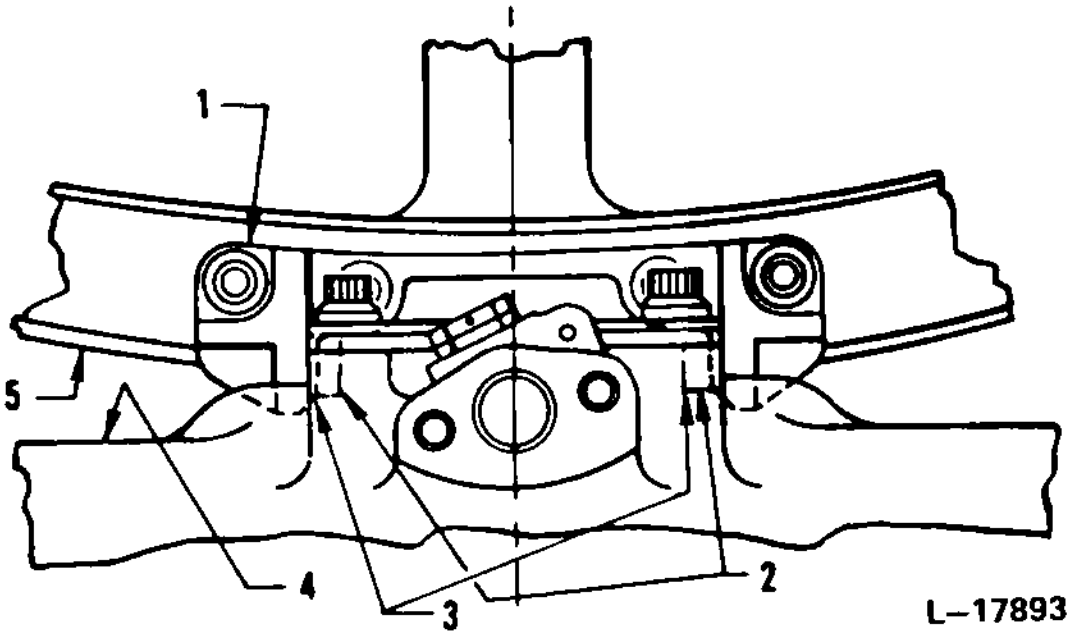
1. Gearbox
2. Gearbox Packing (2) (PN 440615 and 565716, Engines Prior to SB 2338)
3. Compressor Intermediate Fan Case
4. Packing (2) (Early Type)
5. No. 2 and 3 Bearings Outer Internal Oil Pressure Tube
6. Packing (2)
7. Gearbox Packing (1) (PN 615697, Engines Incorporating SB 2338)
8. Packing (1) (Tube Ref. PN 719336)

No. 2 and 3 Bearings Outer Internal Oil Pressure Tube Installation
Figure 402 (Sheet 1)
(Task 72-60-00-990-002)



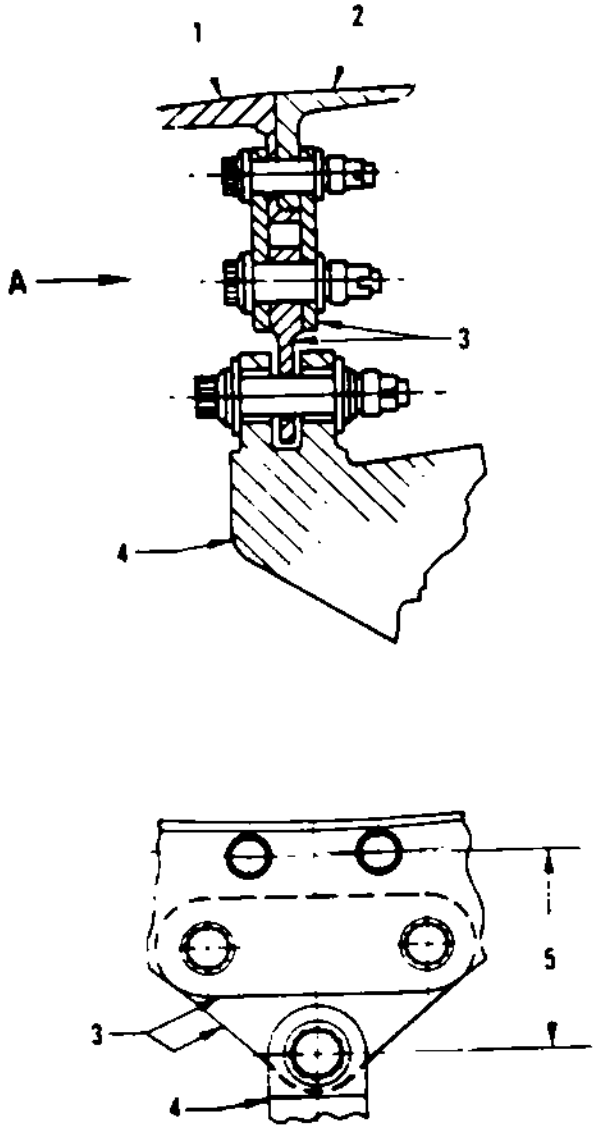
1. Compressor - Intermediate Case Rear Flange
2. Mounting Pin Lock Plate
3. Bolt And Lockwire
4. Mounting Pin
5. Mounting Bracket
6. Bracket Spacer

Gearbox Rear Support Bracket
Figure 402 (Sheet 2)
(Task 72-60-00-990-002)



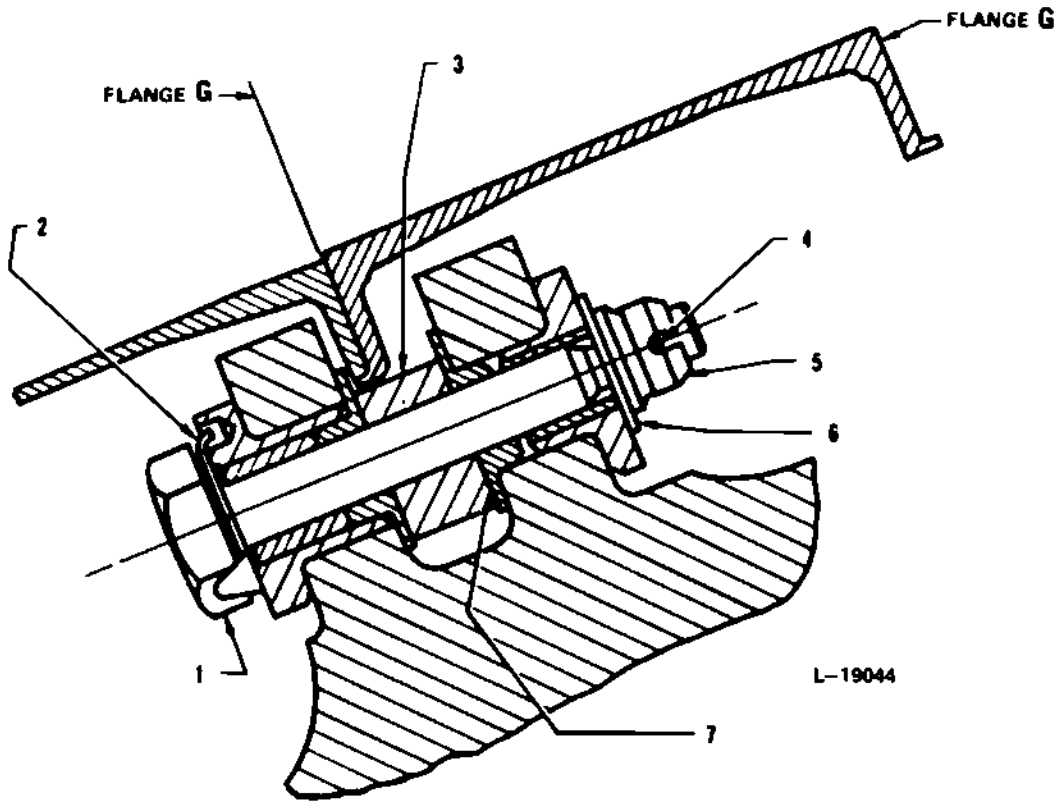
1. Gearbox Lug Guide
2. Left And Right Gearbox Lug
3. See Inspection/Check-02, Reference Number 1157 and 1158
4. Gearbox
5. Compressor Intermediate Case

Gearbox Lugs and Lug Guide - Installation
Figure 403
(Task 72-60-00-990-002)



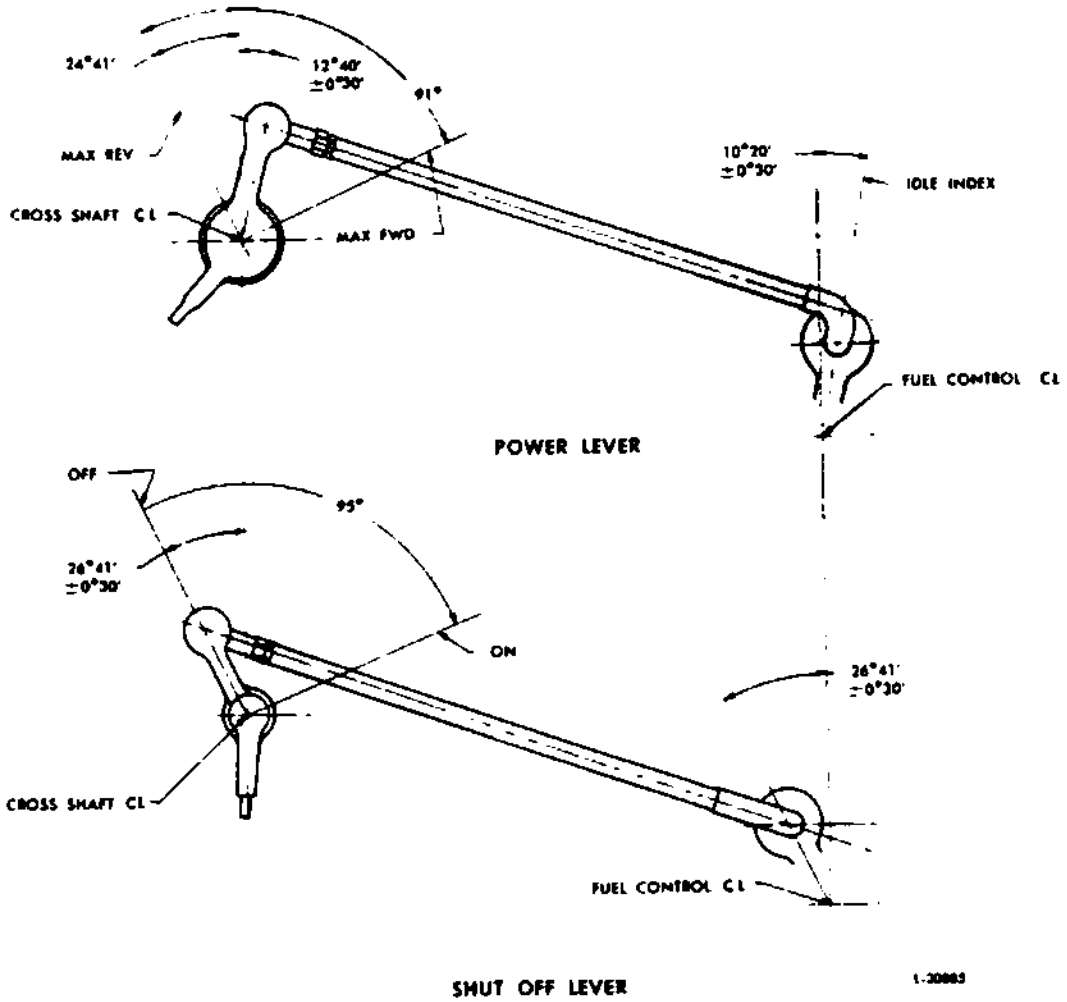
1. Fan Exit Case
2. Fan Discharge Outer Duct
3. Mount Brackets
4. Gearbox Front Mount Arm
5. 2.030 To 2.068 Inches

Gearbox Front Mount
Arm Dimensional Check
Figure 404
(Task 72-60-00-990-002)

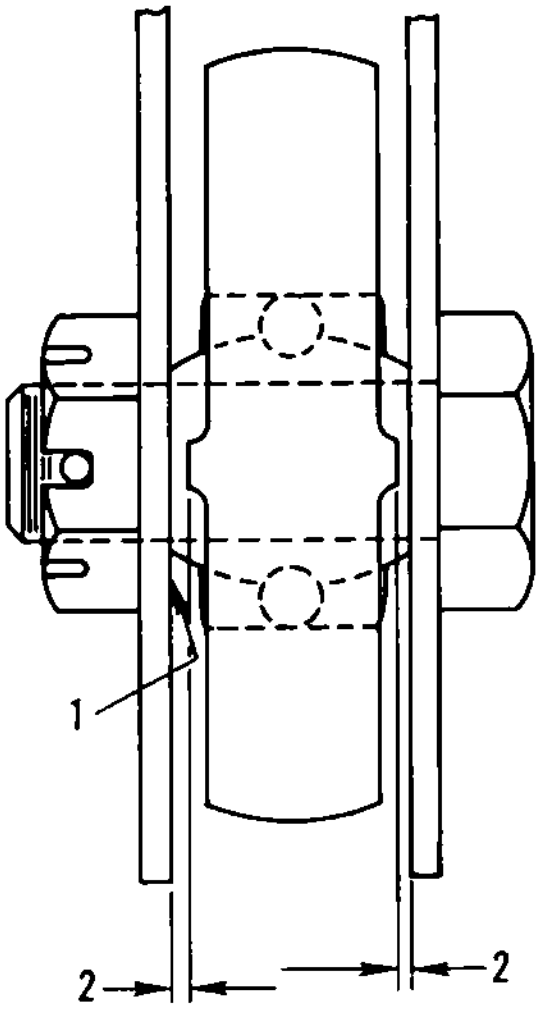


1. Mounting Bolt (2 Required)
2. Tablock (2 Required)
3. Pin Bar (Reference)
4. Cotterpin (2 Required)
5. Nut (2 Required)
6. Washer (2 Required)
7. Select Pin Bar To Allow 0.000 To 0.001 Inch Gap Before Torque

Axial Lug Gearbox Mounting
Figure 405
(Task 72-60-00-990-002)



Power Lever Cross Shaft and
Shutoff Lever Linkage Adjustments
Figure 406 (Sheet 1)
(Task 72-60-00-990-002)



FUEL CONTROL LINKS
(TYPICAL FOR SHUTOFF LINK AND POWER LEVER LINK)

L–78263

1. Nut Torque Should Provide Firm Contact Between Linkage Arm And Rod End Uniball, Both Sides
2. 0.006 Inch Minimum Gap Between "Bumper" And Linkage Arm, Both Sides Simultaneously, After Both Ends Of Rod Are Installed On Engine And For Full Travel Of Linkage

Fuel Control Power Lever And
Fuel Shutoff Lever Assembly

Figure 406 (Sheet 2)
(Task 72-60-00-990-002)

Task 72-60-00-210-001:

1. Accessory Drives Section

A. Check Concentricity And Squareness Of Accessory Drives As Follows:

R CAUTION: AS WITH ALL INSPECTION TOOLS, IT IS IMPORTANT
R THAT THE PWA 33713 SPLINE ADAPTER BE IN
R SERVICEABLE CONDITION, NOT DAMAGED, AND TO
R DRAWING SPECIFICATIONS. IT IS ALSO NECESSARY
R THAT THE ADAPTER BE TO THE CURRENT DESIGN
R LEVEL (AS SPECIFIED BY TOOL BULLETINS). IT
R WILL BE NECESSARY TO OBEY THE INSTRUCTIONS
R BELOW TO MAKE SURE THAT THE READINGS ARE
R CORRECT. TRAINING, EXPERIENCE, AND TECHNIQUE
R ARE NECESSARY TO USE THIS TOOL CORRECTLY AND
R GET ACCURATE READINGS

R (1) Do a check of the fuel pump drive for concentricity and
R squareness with 33713 Spline Adapter. See Figure 601,
R Figure 602, and Figure 603.

R NOTE: This procedure measures the concentricity and
R squareness of the gearbox fuel pump drive pad
R in relation to the fuel pump mating internal
R spline of the gearshaft in the gearbox. The
R inspection is done with two assembly conditions,
R one with the quick-disconnect rear coupling
R assembled to the gearbox fuel pump pad, and one
R with the rear coupling removed. For each of
R these conditions the inspection is done with the
R internal gearshaft pulled outward (away from
R the gearbox) and again with the gearshaft
R pushed inward (toward the gearbox). The first
R inspection is done with the quick-disconnect
R coupling assembled on the gearbox. If the
R results of this inspection are not in the limits
R specified, then the inspection is done again
R with the quick-disconnect coupling removed (with
R inward and outward shaft loads). This is to
R find if the problem is with the quick-disconnect
R coupling or with the gearbox. All inspection
R surfaces must be clean.

R (a) With quick-disconnect coupling assembled to
R gearbox.

R 1 Remove the quick-disconnect front coupling and quick-disconnect nut assembly from the fuel pump. Refer to 73-11-01, Removal/Installation-00 (Task 73-11-01-450-001). Install the front coupling and nut on the rear coupling on the gearbox. Make sure that two bolts used to attach the front coupling to the fuel pump extend adjacent to each other forward from the top of the front coupling (it will be necessary to use these bolts to attach the PWA tool to the gearbox). Engage and tighten the nut threads with the same procedure used for installation of the fuel pump and control. Refer to 73-11-01, Removal/Installation-00 (Task 73-11-01-450-001).

R 2 Remove the tool ball lockpin that attaches the tool arm assembly to the tool bracket. Install the tool bracket assembly on the two bolts that extend forward from the front coupling. Use the tool nut to hold the bracket in position at the slotted holes in the tool bracket.

R NOTE: In the end of the gearshaft you will see that there are two positions 180 degrees apart where there are short splines which do not extend as far outward as other splines. It will be important to have the two detail pins in the expandable tool segments engage a full-length section of the spline, so be sure to install the tool post with these two detail pins 90 degrees away from the two short splines. Examine the splines for damage that will not let the two detail pins engage the splines.

R 3 Turn back the detail nut on the tool (post and nut) to pull in the expandable post segments. Put the post and nut in the fuel pump gearshaft spline with the two detail pins of the expandable post segments engaged in the spline.

R NOTE: Use a 3/16 inch open-end wrench on the flats of the tool post to make sure that the post does not turn. Tighten the knurled tool nut by hand to make sure

R that the two pins are tight against the
R full-length splines in the gearshaft.
R If the tool nut does not hold the pins
R tight against the spline, the readings
R will not be correct and will not have
R constant values.

R 4 Use the knurled nut to make sure that the
R assembly is tight. Make sure that the adapter
R does not touch the end of the fuel pump
R gearshaft (you can use a 0.010 inch feeler gage
R between the end of the gearshaft and the
R adjacent nut to make sure that they do not
R touch). Do not make this clearance too large
R (keep it to less than 0.030 inch).

R 5 Outward load of the fuel pump gearshaft (away
R from the gearbox)

R a Put the tool guide assembly detail through
R the elongated slot in the tool detail arm
R with the two balls in the yoke end outward,
R away from the gearbox. Put the tool spring
R on the guide and install the yoke into the
R groove of the tool nut. Attach the tool
R spring and guide to the gearbox through the
R hole in the bracket assembly.

R NOTE: Use the internally threaded guide
R during an inspection with the
R quick-disconnect coupling installed
R on the gearbox.

R b Use the detail ball lock pin to attach the
R fulcrum slot of the tool arm to the fulcrum
R post of the tool. Tighten the guide against
R the tool bracket.

R CAUTION: THE TOOL RANGE WILL BE
R APPROXIMATELY 300 DEGREES. DO NOT
R TURN THE INDICATOR THROUGH MORE
R THAN THIS RANGE (THIS WILL CAUSE
R DAMAGE TO THE TOOL).

R c Attach a standard swivel and extension rod
R to the tool post. Attach a dial indicator
R correct for this operation to the extension
R rod. Set the dial indicator to zero against

R the larger (forward) inner diameter of the
R front coupling (the diameter that is the
R mating surface for the outer diameter of
R the fuel pump flange). Use a 10408 Adapter
R in the starter drive spline to slowly turn
R the gearbox drives and turn the indicator
R through the full available range (refer
R to the Caution above). Record the full
R indicator reading on the recording sheet
R shown in Figure 603.

R d Put the stem of the indicator where it can
R move along the bolt hole circle centerline
R during the squareness check. Use 10408
R Adapter in the starter drive to slowly turn
R the gearbox drives and turn the indicator
R through the full available range (refer
R to the Caution above). Record the full
R indicator reading on the recording sheet.

R e Remove the swivel, extension rod, and dial
R indicator. Remove the tool guide, tool ball
R lock pin, and tool arm.

R 6 Inward load of the fuel pump gearshaft (toward
R the gearbox)

R a Put the tool spring on the guide. Install
R the tool guide assembly detail through the
R elongated slot in the tool detail arm with
R the two balls on the yoke end inward, toward
R the gearbox. Install the yoke into the
R groove of the tool nut. Attach the tool
R spring and guide assembly to the bolt that
R extends through the hole in the bracket
R assembly.

R NOTE: Use the internally threaded guide
R during an inspection with the
R quick-disconnect coupling installed
R on the gearbox. Turn this guide onto
R the bolt that comes through the hole
R in the bracket assembly.

R b Use the detail ball lock pin to attach the
R fulcrum slot of the tool arm with the
R fulcrum post of the tool. Tighten the guide
R against the tool bracket.

R CAUTION: THE TOOL RANGE WILL BE
R APPROXIMATELY 300 DEGREES. DO NOT
R TURN THE INDICATOR THROUGH MORE
R THAN THIS RANGE (THIS WILL CAUSE
R DAMAGE TO THE TOOL).

R c. Attach a standard swivel and extension rod
R to the tool post. Attach a dial indicator
R correct for this operation to the extension
R rod. Set the dial indicator to zero against
R the larger (forward) inner diameter of the
R front coupling (the diameter that is the
R mating surface for the outer diameter of
R the fuel pump flange). Use a 10408 Adapter
R in the starter drive spline to slowly turn
R the gearbox drives and turn the indicator
R through the full available range (refer
R to the Caution above). Record the full
R indicator reading on the recording sheet.

R d. Put the stem of the indicator where it can
R move along the bolt hole circle centerline
R during the squareness check. Use 10408
R Adapter in the starter drive to slowly turn
R the gearbox drives and turn the indicator
R through the full available range (refer
R to the Caution above). Record the full
R indicator reading on the recording sheet.

R e. Remove the swivel, extension rod, and dial
R indicator. Remove the tool guide, tool ball
R lock pin, and tool arm.

R 7. The concentricity and squareness limits
R (with the quick-disconnect coupling assembly
R installed on the gearbox and inward and outward
R loads on the fuel pump gearshaft) are:

R a. Concentricity: 0.008 inch maximum

R b. Squareness: 0.006 inch maximum

R 8. If the fuel pump quick-disconnect coupling
R readings are in the above limits, this check
R is completed, and no more inspection is
R necessary. Put the front coupling and nut back
R on the fuel pump and install the fuel pump and
R control package on the gearbox as specified
R in 73-11-01, Removal/Installation-00 (Task
R 73-11-01-450-001).

R 9. If the fuel pump quick-disconnect coupling
R readings are not in limits, go on to the
R inspection procedure that follows.

R (b) With quick-disconnect coupling removed from
R gearbox.

R 1. Remove the fuel pump rear coupling
R from the gearbox. Refer to 72-61-00,
R Removal/Installation-00 (Task
R 72-61-00-430-013).

R 2. Remove the tool lock pin that attaches the tool
R arm assembly to the tool bracket. Put the tool
R spacer, then the tool bracket on the first two
R bolts clockwise from the larger-diameter dowel
R pin on the gearbox pad. Attach the bracket
R with the tool bolt at the slotted hole in the
R tool bracket.

R NOTE: In the end of the gearshaft you will
R see that there are two positions 180
R degrees apart where there are short
R splines which do not extend as far
R outward as other splines. It will be
R important to have the two detail pins in
R the expandable tool segments engage a
R full-length section of the spline, so be
R sure to install the tool post with these
R two detail pins 90 degrees away from the
R two short splines. Examine the splines
R for damage that will not let the two
R detail pins engage the splines.

R 3. Turn back the detail nut on the tool (post and
R nut) to pull in the expandable post segments.
R Put the post and nut in the fuel pump gearshaft

R spline with the two detail pins of the
R expandable post segments engaged in the spline.

R NOTE: Use a 3/16 inch open-end wrench on the
R flats of the tool post to make sure that
R the post does not turn. Tighten the
R knurled tool nut by hand to make sure
R that the two pins are tight against the
R full-length splines in the gearshaft.
R If the tool nut does not hold the pins
R tight against the spline, the readings
R will not be correct and will not have
R constant values.

R 4. Use the knurled nut to make sure that the
R assembly is tight. Make sure that the adapter
R does not touch the end of the fuel pump
R gearshaft (you can use a 0.010 inch feeler gage
R between the end of the gearshaft and the
R adjacent nut to make sure that they do not
R touch). Do not make this clearance too large
R (keep it to less than 0.030 inch).

R 5. Outward load of the fuel pump gearshaft (away
R from the gearbox)

R a. Put the tool guide assembly detail through
R the elongated slot in the tool detail arm
R with the two balls in the yoke end outward,
R away from the gearbox. Put the tool spring
R on the guide and install the yoke into the
R groove of the tool nut. Attach the tool
R spring and guide to the gearbox through the
R hole in the bracket assembly.

R NOTE: Use the externally threaded guide
R during an inspection with the
R quick-disconnect coupling removed
R from the gearbox.

R b. Use the detail ball lock pin to attach the
R fulcrum slot of the tool arm to the fulcrum
R post of the tool. Tighten the guide against
R the tool bracket.

R CAUTION: THE TOOL RANGE WILL BE
R APPROXIMATELY 300 DEGREES. DO NOT
R TURN THE INDICATOR THROUGH MORE
R THAN THIS RANGE (THIS WILL CAUSE
R DAMAGE TO THE TOOL).

R c Attach a standard swivel and extension rod
R to the tool post. Attach a dial indicator
R correct for this operation to the extension
R rod. Set the dial indicator to zero against
R the inner diameter of the gearbox fuel pump
R pad. Use a 10408 Adapter in the starter
R drive spline to slowly turn the gearbox
R drives and turn the indicator through the
R full available range (refer to the Caution
R above). Record the full indicator reading
R on the recording sheet shown in Figure 603.

R d Put the stem of the indicator where it can
R move along the bolt hole circle centerline
R during the squareness check. Use 10408
R Adapter in the starter drive to slowly turn
R the gearbox drives and turn the indicator
R through the full available range (refer
R to the Caution above). Record the full
R indicator reading on the recording sheet.

R e Remove the swivel, extension rod, and dial
R indicator. Remove the tool guide, tool ball
R lock pin, and tool arm.

R 6 Inward load of the fuel pump gearshaft (toward
R the gearbox)

R a Put the tool spring on the guide. Install
R the tool guide assembly detail through the
R elongated slot in the tool detail arm with
R the two balls on the yoke end inward, toward
R the gearbox. Install the yoke into the
R groove of the tool nut. Attach the tool
R spring and guide assembly to the bolt that
R extends through the hole in the bracket
R assembly.

R NOTE: Use the externally threaded guide
R during an inspection with the
R quick-disconnect coupling removed
R from the gearbox. Turn this guide

R onto the bolt that comes through the
R hole in the bracket assembly.

R b Use the detail ball lock pin to attach the
R fulcrum slot of the tool arm with the
R fulcrum post of the tool. Tighten the guide
R against the tool bracket.

R CAUTION: THE TOOL RANGE WILL BE
R APPROXIMATELY 300 DEGREES. DO NOT
R TURN THE INDICATOR THROUGH MORE
R THAN THIS RANGE (THIS WILL CAUSE
R DAMAGE TO THE TOOL).

R c Attach a standard swivel and extension rod
R to the tool post. Attach a dial indicator
R correct for this operation to the extension
R rod. Set the dial indicator to zero against
R the inner diameter of the gearbox fuel pump
R pad. Use a 10408 Adapter in the starter
R drive spline to slowly turn the gearbox
R drives and turn the indicator through the
R full available range (refer to the Caution
R above). Record the full indicator reading
R on the recording sheet.

R d Put the stem of the indicator where it can
R move along the bolt hole circle centerline
R during the squareness check. Use 10408
R Adapter in the starter drive to slowly turn
R the gearbox drives and turn the indicator
R through the full available range (refer
R to the Caution above). Record the full
R indicator reading on the recording sheet.

R e Remove the swivel, extension rod, and dial
R indicator. Remove the tool guide, tool ball
R lock pin, and tool arm.

R 7. The concentricity and squareness limits (with
R the quick-disconnect coupling assembly removed
R from the gearbox and inward and outward loads
R on the fuel pump gearshaft) are:

R a Concentricity: 0.008 inch maximum

R b Squareness: 0.006 inch maximum

R 8 If the fuel pad readings are in the above
R limits, and the readings from inspection
R with the quick-disconnect coupling assembly
R installed were not in limits, replace
R the coupling assembly as specified in
R 73-11-01, Removal/Installation-00 (Task
R 73-11-01-450-001). This will usually correct
R the problem.

R 9 If the readings from the quick-disconnect
R coupling and from the gearbox fuel pump pad
R are not in limits, remove the gearbox as
R specified in Removal/Installation-01 (Task
R 72-60-00-420-001) for corrective action.
R It is possible that the condition of the
R quick-disconnect coupling assembly will be
R satisfactory, and it is recommended that the
R coupling assembly get a full inspection before
R it is installed back on a gearbox. Refer to
R the coupling inspection in this section.

R 10 Where applicable, install the front coupling
R assembly on the flange of the fuel pump. Refer
R to 73-11-01, Removal/Installation-00 (Task
R 73-11-01-450-001).

R 11 Where applicable, install the fuel pump and
R control package on the gearbox as specified
R in 73-11-01, Removal/Installation-00 (Task
R 73-11-01-450-001).

(2) Check Hydraulic Pump Drive for concentricity and
R squareness using PWA 33788 Gage. See Figure 604.

(a) Position detail bracket on any two studs on hydraulic pump drive and secure with detail nut at slotted hole.

(b) Insert detail gage assembly into hydraulic pump drive so that detail pin on expendable segments engage spline ID.

(c) With gage contacting end of hydraulic pump gearshaft, tighten knurl nut.

NOTE: Use suitable wrench on flats of post to hold post from turning.

(d) Load hydraulic pump drive gearshaft outward.

1 Place detail guide through elongated slot in detail arm assembly with two balls up. Place detail spring over guide and insert yoke end of arm into neck of gage.

2 Thread guide onto stud coming through hole in bracket.

3 Secure fulcrum slot of detail arm to fulcrum post of detail bracket with detail ball lock pin. Tighten guide if necessary.

(e) Load hydraulic pump drive gearshaft inward.

1 Place detail spring over guide and insert into elongated slot of detail arm assembly with two balls down on yoke end. Insert yoke into neck of gage.

2 Thread guide onto stud coming through hole in bracket.

3 Secure fulcrum slot of detail arm to fulcrum post of detail bracket with detail ball lock pin. Tighten guide if necessary.

CAUTION: TOOL SWING IS APPROXIMATELY 300 DEGREES.

(f) Attach suitable swivel and extension rod to center post of gage. Attach suitable dial indicator to extension rod. Zero dial indicator to hydraulic pump pad ID and face. Rotate gearbox gears using PWA 10408 Adapter to check concentricity and squareness.

1 Concentricity limit is 0.000 - 0.008 inch FIR, squareness limit is 0.000 - 0.006 inch FIR.

2 If hydraulic pump drive concentricity and squareness are not within above limits, replace gearbox assembly.

(3) Check N2 Tachometer Drive for concentricity and
R squareness using PWA 33789 Gage. See Figure 605.

ACCESSORY AND COMPONENT DRIVES GEARBOX
HOUSING SECTION - INSPECTION/CHECK-00

(a) Position detail hollow shaft, with split ring and clamp assembled, split ring end down over tachometer drive it bottoms.

(b) Using suitable wrenches on flats of hollow shaft and clamp, tighten until split ring is secured to protruding end of N2 tachometer drive to withstand 15 - 20 lb. pull.

(c) Load N2 tachometer drive outward

1 Slide detail flanged collar over hollow shaft with flange end down until seated on seal housing retaining ring.

2 Assemble detail thrust bearing, washer, and spring in this order over hollow shaft.

3 Install small detail knurl nut to hollow shaft and tighten.

(d) Load N2 tachometer drive inward.

1 Slide detail sleeve over hollow shaft with lug end down.

2 Assemble detail spring, washer, and thrust bearing inside of sleeve in this order. Secure with large detail knurl nut.

3 Push assembled sleeve down over hollow shaft, aligning washer and thrust bearing, into seal housing and turn one quarter-turn to align sleeve lugs under seal housing lugs.

(e) Insert detail tube assembled with square collet, threaded shaft, and knurl nut with post into hollow shaft engaging square tachometer drive. Tighten knurl nut to secure square collet in tachometer drive.

(f) Attach standard swivel and extension rod to post on knurl nut. Attach suitable dial indicator to extension rod, zero dial indicator and turn gearbox using PWA 10408 Adapter to check concentricity and squareness.

R
R

1 Concentricity and squareness limits are 0.000 - 0.010 inch FIR.

2 If concentricity or squareness are not within limits, replace gearbox assembly.

B. Fuel Pump Coupling Inspection

R See Figure 606.

(1) Fuel Pump Front Coupling Inspection

(a) Examine the outer edge of the fuel pump coupling for damage or worn areas.

(b) Measure Dimensions A and B as shown in Sheet 1 of the figure. If Dimension A or B is not in the limits shown, replace the coupling.

(2) Fuel Pump Rear Coupling Inspection

(a) Examine the front face of the fuel pump rear coupling for damage or worn areas.

(b) Measure Dimension C as shown in Sheet 1 of the figure. If Dimension C is more than the limit shown, replace the coupling.

(c) Examine the threads for worn areas as shown in Sheet 3 of the figure. If a wear step is found which is more than the limit given, replace the coupling.

(3) Fuel Pump Quick-Disconnect Nut Locking Bolt

(a) Examine the bolt for damage or worn areas. Replace a bolt which has damage which will prevent safe installation.

(4) Quick-Disconnect Nut

(a) Examine the area shown in Sheet 1 of the figure for damage or worn areas.

(b) Measure Dimension D shown in the figure. If Dimension D is below the limits shown, replace the nut.

(c) Examine the threads for damage or worn areas as shown in Sheet 2 of the figure. If a wear step is found which is more than the limits given, replace the nut.

C. Main Gearbox CSD Drive Gear Movement Check

R See Figure 607.

(1) General

NOTE: Do this check when the CSD is removed from the engine and the rear surface of the gearbox is open for inspection. See the Aircraft Maintenance Manual, Section 24.

(a) The main accessory gearshaft (which sends power to the CSD) is held in position by a ball bearing at the rear end and supported by a roller bearing at the front end. Both bearings are installed in bushings pressed into the gearbox housing. If the rear bushing becomes worn or damaged and starts to move forward in the gearbox housing, the gearshaft will move forward also. If this movement goes too far, it can cause the bevel gear teeth to be disengaged from the teeth of the towershaft bevel gear, and tooth damage and gear failure can follow.

(b) Inspections have found that up to approximately 0.125 inch of movement is possible. This condition has been difficult to measure on assembled gearboxes but is easy to find during gearbox rear housing inspection.

(c) The purpose of the inspection procedure that follows is to make it possible to see if this movement has occurred in an assembled gearbox. Two checks are given, one a distance measured from the rear face of the gearbox to the end of the CSD coupling, the other measured from the gearbox rear face to the rear surface of the gearshaft ball bearing. If the first distance is not in limits, the second inspection is recommended.

(d) It is now recommended that operators measure the two important gearshaft positions at gearbox assembly and keep these numbers with the engine records. If the distance is measured at gearbox assembly, it will be possible to compare the initial assembly distance with the distance seen after engine operation.

(e) If the gearshaft position inspection was done and the record is available, compare the gearshaft position in the inspection procedure that follows with the distances from the engine record to calculate gearshaft movement. If the inspection was not done before, or the record is not available, use the limits specified below. If the inspection distance increases after gearbox assembly and a period of engine operation, there is gearshaft movement.

(2) Procedure

(a) Measure the distance (Distance 1) from the rear (CSD mating) flange surface of the gearbox rear housing to the end face of the CSD coupling as shown in Figure 607.

R

1 If an engine record of gearshaft position is available:

a Compare the distance from the gearbox CSD mating flange to the end of the CSD coupling with the recorded dimension from engine records.

b If the measured distance is more than the recorded distance, it is possible there was gearshaft movement. Go to step 2.

2 If there is no record of gearshaft position:

a If the gearbox parts are in good condition, this dimension will be 0.304 - 0.336 inch (with 0.320 inch as an average). If this distance is more than 0.336 inch, worn or damaged internal parts let the gearshaft to move forward more than is permitted. Go to step (b).

(b) If the distance measured in step (a) is not in limits (or is more than the distance at gearbox assembly), remove the seal assembly from the CSD drive (see Chapter/Section 72-61-0, Removal/Installation). Measure the distance (Distance 2) from the gearbox rear face to the rear face of the ball bearing outer race as shown in the figure.

1 If an engine record of gearshaft position is available:

a Compare the distance from the gearbox CSD mating flange to the rear of the CSD gearshaft ball bearing outer race with the recorded dimension from engine records.

b If the measured distance is more than the recorded distance, then the gearshaft moved.

2 If there is no record of gearshaft position:

a If the gearbox parts are in good condition, this distance is usually 1.606 - 1.623 inches. If the distance measured is more than 1.623 inches, it is possible that there is damage to the internal parts which causes movement of the gearshaft.

(c) When the inspection is completed, install the seal and housing assembly (see Chapter/Section 72-61-00, Removal/Installation-00).

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1. Nut
2. Post
3. Guide Assembly, Internally Threaded For Use With Quick-Disconnect Coupling Installed On Gearbox Assembly
4. Spring, Over Index 7 Arm Assembly When Inward Loading, Under Index 7 Arm Assembly When Outward Loading
5. Bracket Assembly
6. Standard Swivel, Extension Rod, And Suitable Dial Indicator
7. Arm Assembly, Used With Two Balls Up For Outward Loading, Used With Two Balls Down For Inward Loading

R 8. Ball-lock Pin
R 9. Fuel Pump Bolt (2)
R 10. Post Pin (2)

Key to Figure 601

R
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1. Nut
2. Post
3. Guide Assembly, Externally Threaded For Use With Quick-Disconnect Coupling Removed From Gearbox Assembly.
4. Spring, Over Index 8 Arm Assembly When Inward Loading, Under Index 8 Arm Assembly When Outward Loading.
5. Bracket Assembly
6. Spacer
7. Standard Swivel, Extension Rod, And Suitable Dial Indicator, Reference
8. Arm Assembly, Used With Two Balls Up For Outward Loading, Used With Two Balls Down For Inward Loading.

R 9. Ball-lock Pin
R 10. Post Pin (2)

Key to Figure 602

R
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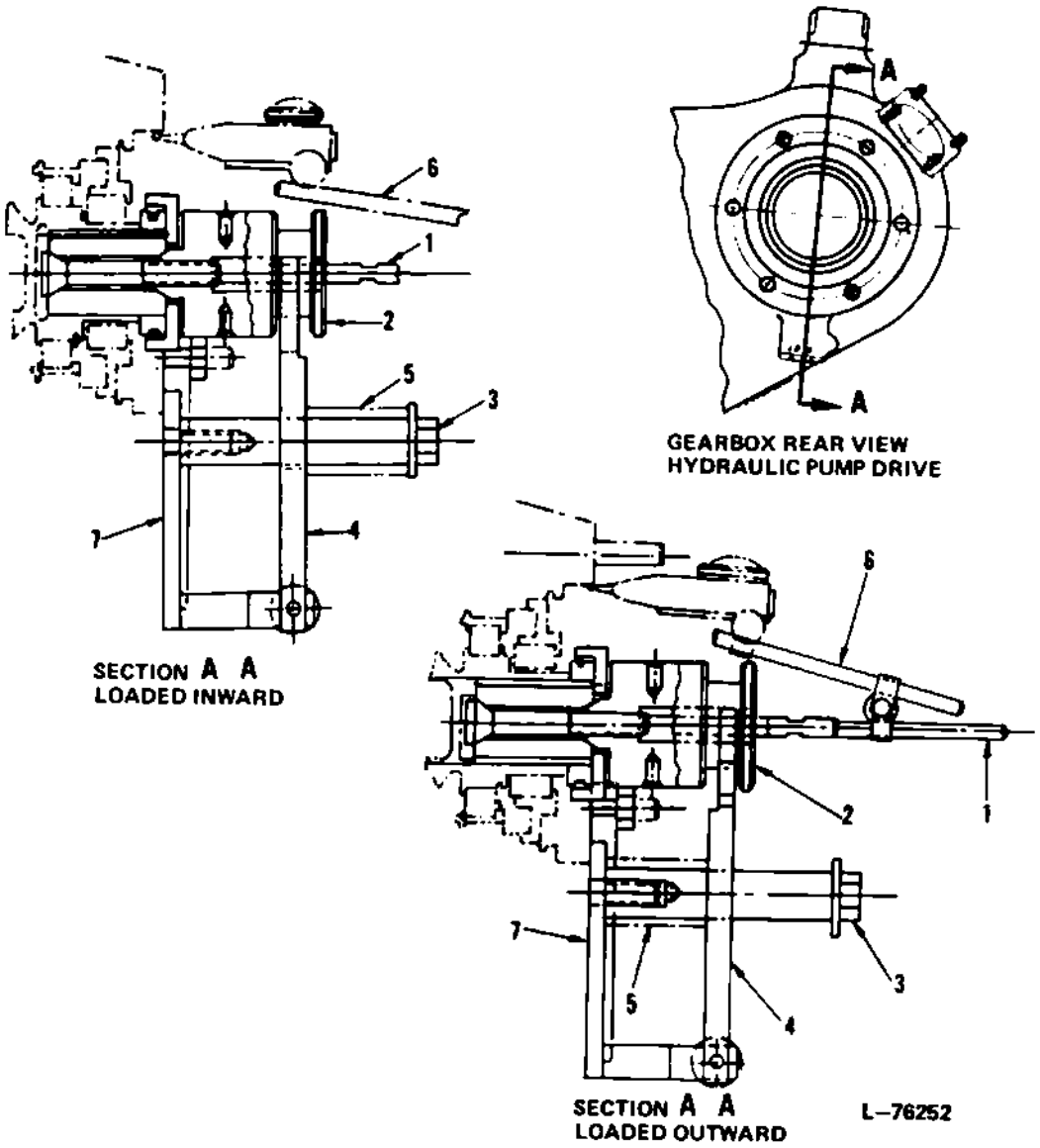
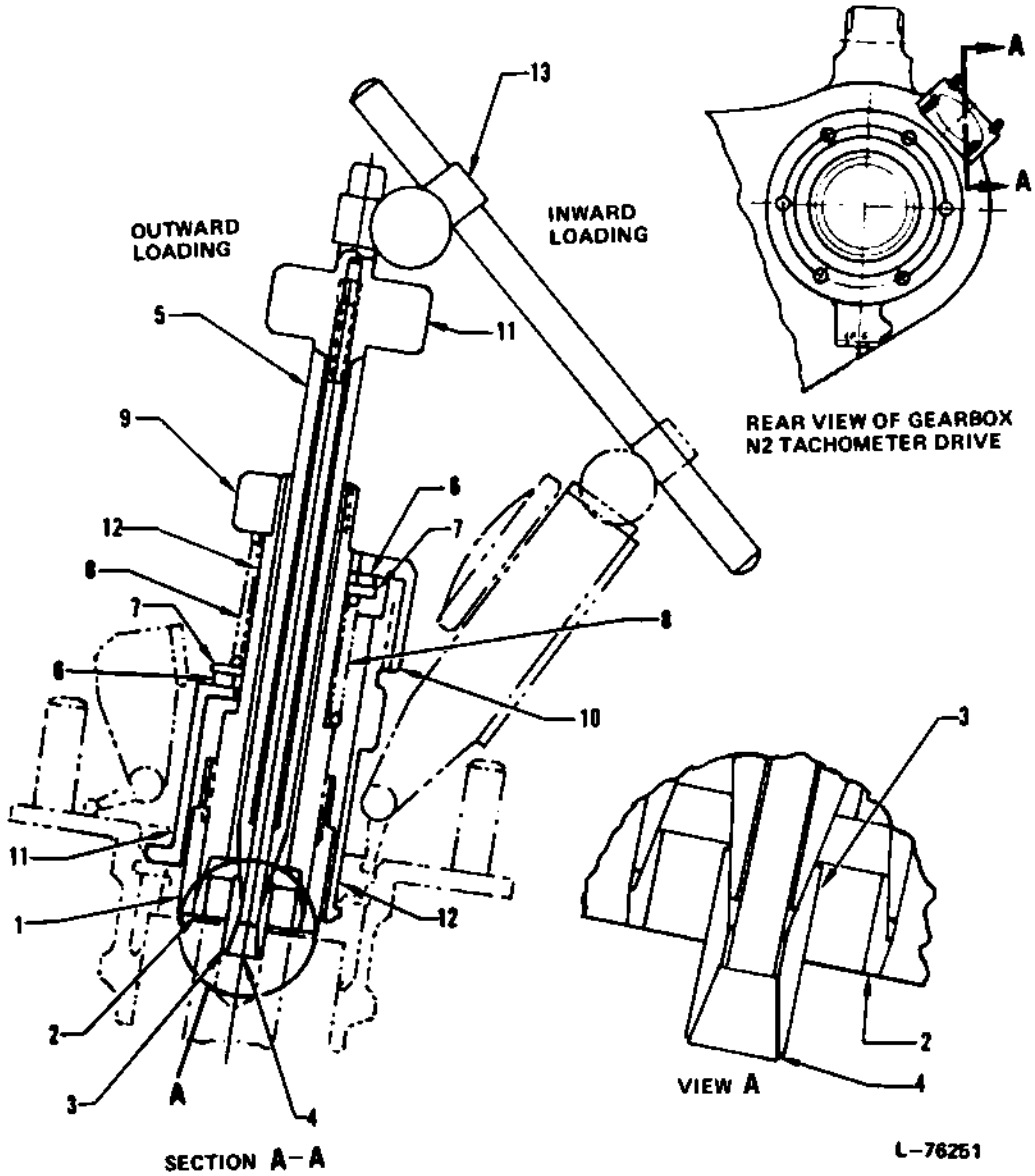


R Hydraulic Pump Drive Concentricity
And Squareness Check
Figure 604
(Task 72-60-00-210-001)

1. Post
2. Gage
3. Guide
4. Arm Assembly, Two Balls Up For Outward Loading, Two Balls Down For Inward Loading.
5. Spring, Between Index 4 Arm And Index 7 Bracket For Outward Loading, On Top Of Index 4 Arm For Inward Loading.
6. Suitable Swivel, Extension Shaft, And Dial Indicator.
7. Bracket Assembly

Key to Figure 604



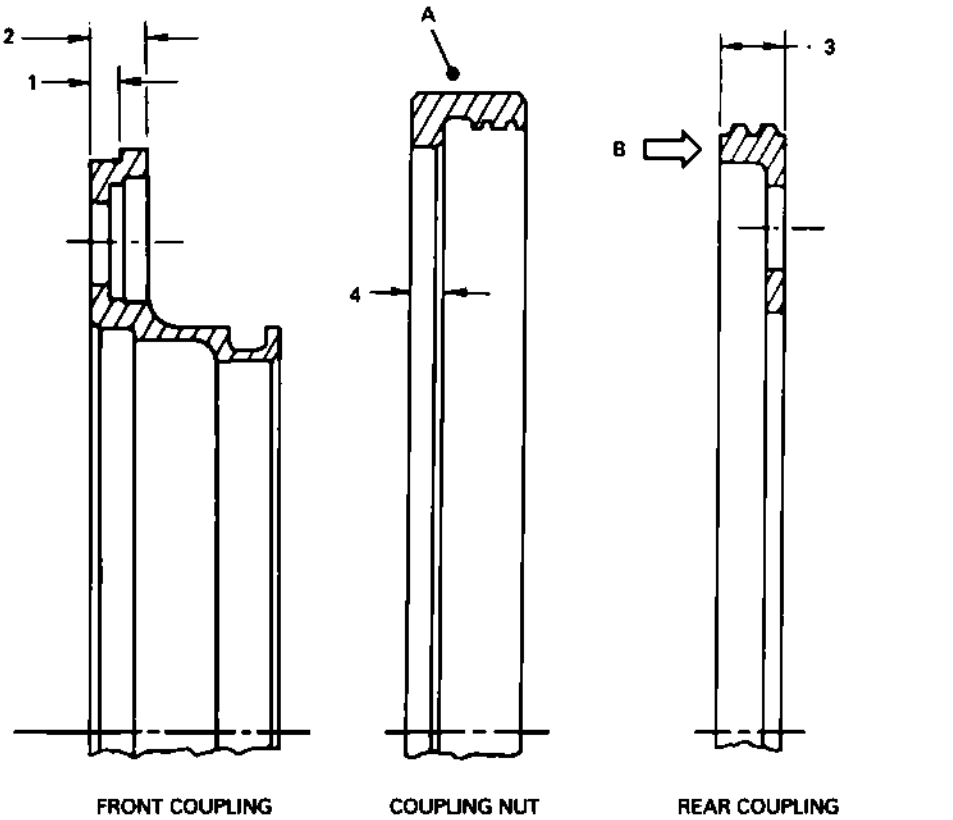
N2 Tachometer Drive Concentricity
And Squareness Check
Figure 605
(Task 72-60-00-210-001)

R

1. Clamp
2. Split Ring
3. Square Collet
4. Shaft
5. Tube
6. Thrust Bearing
7. Washer
8. Spring
9. Small Knurl Nut
10. Large Knurl Nut
11. Knurl Nut, With Post
12. Hollow Shaft
13. Standard Swivel And Extension

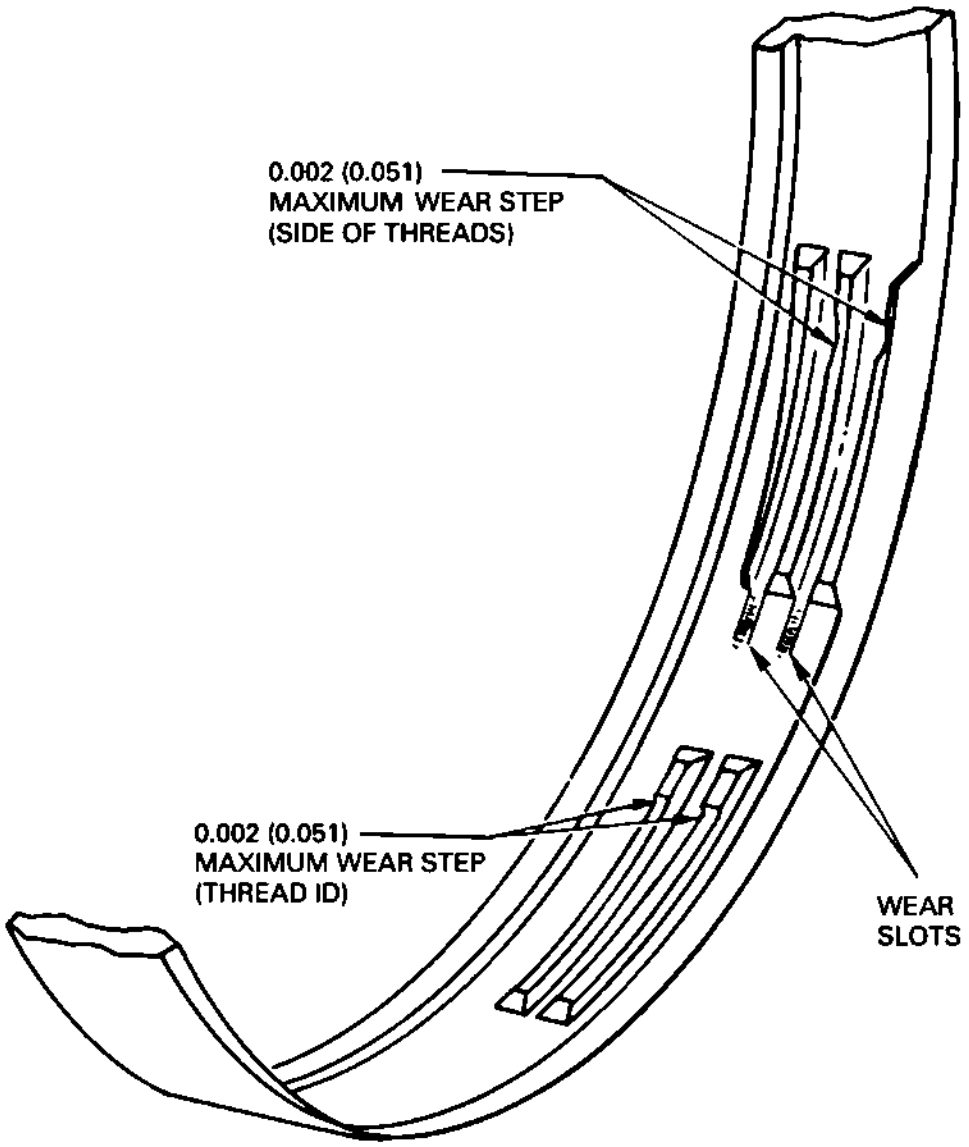
Key to Figure 605

R
R



1. Dimension A, 0.159 Inch Maximum
2. Dimension B, 0.277 Inch Minimum
3. Dimension C, 0.307 Inch Minimum
4. Dimension D, 0.147 Inch Minimum

R Fuel Pump Coupling Inspection
Figure 606 (Sheet 1)
(Task 72-60-00-210-001)



INNER VIEW AT A

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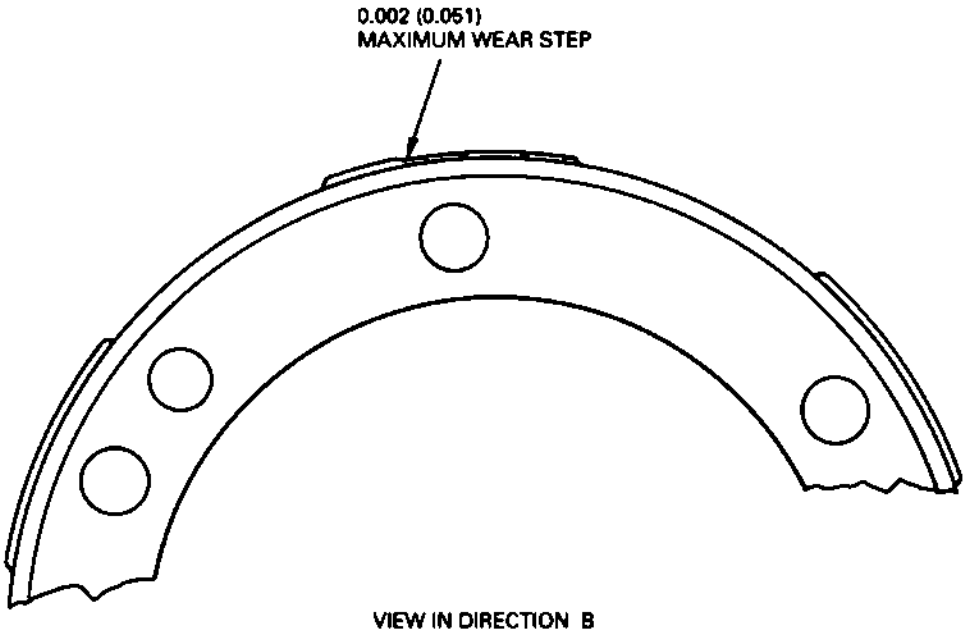
R

Fuel Pump Coupling Inspection
Figure 606 (Sheet 2)
(Task 72-60-00-210-001)



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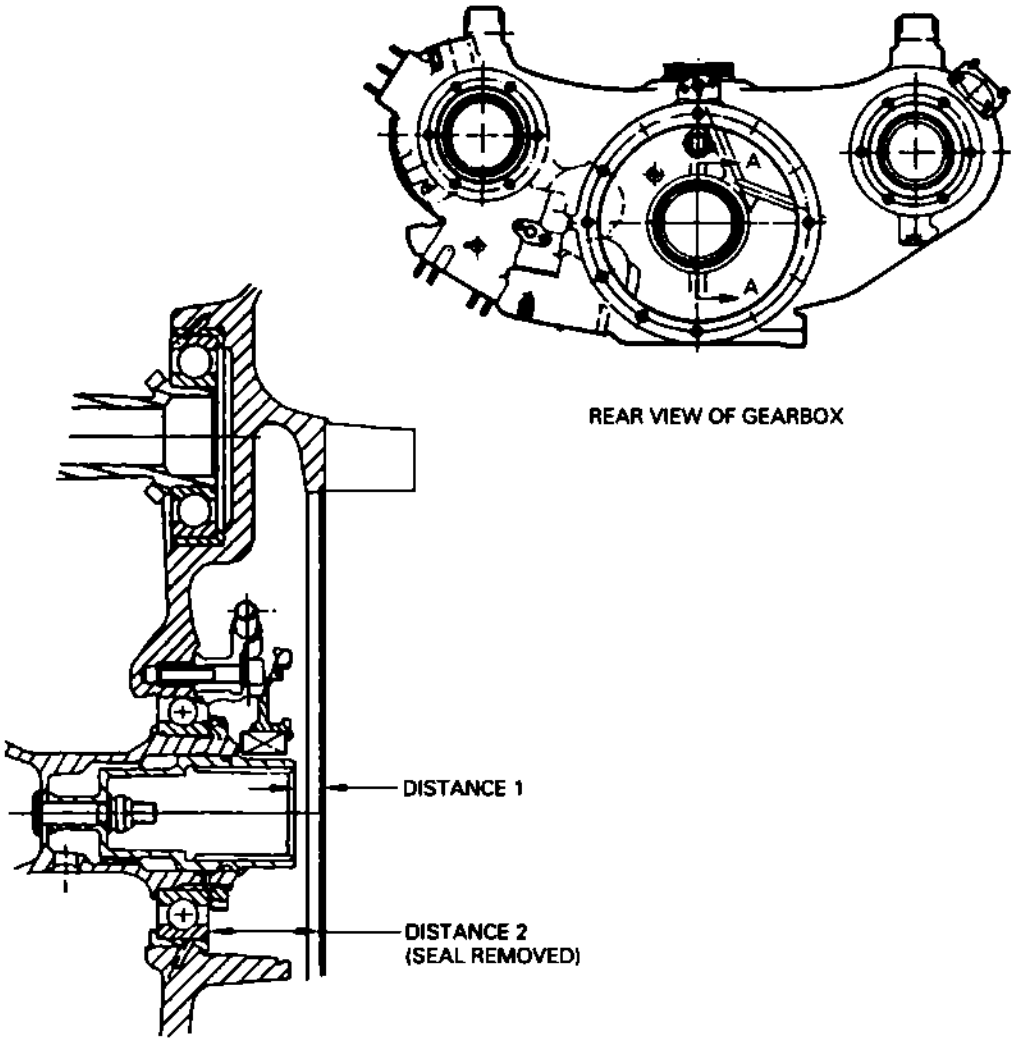
R Fuel Pump Coupling Inspection
Figure 606 (Sheet 3)
(Task 72-60-00-210-001)



Main Gearbox CSD Drive
Gear Movement Check
Figure 607
(Task 72-60-00-210-001)

R

Task 72-60-00-990-008:

1. Accessory Drive Fits And Clearances

See Figure 601 (Sheet 1) thru (Sheet 6).

A. Fits And Clearances

REF NO.	DESCRIPTION	REF. DIMENSIONS MIN	REF. DIMENSIONS MAX	LIMITS MIN	LIMITS MAX	REPLACE IF OVER
1102	Nut-Locknut, Accy Drive Pad					
	PN 403326 Nut (Used With PN 308893 Bracket): 0.500 - 1.160 Inch					
	PN 522709 Nut (Used With PN 522830 Bracket); 0.300 - 1.160 Inch					
	Gearbox Quick-Disconnect Nut (Fuel Pump) Tightening Procedure:					
	(1) Prior to installing fuel pump, apply engine oil to threads of gearbox quick-disconnect nut assembly and rear coupling.					
	(2) Apply engine oil to threads of .250-28 bolt attached to nut assembly.					

REF NO.	DESCRIPTION	REF. DIMENSIONS MIN	REF. DIMENSIONS MAX	LIMITS MIN	LIMITS MAX	REPLACE IF OVER
(CONTINUED)						
	(3) Support fuel pump and control so that no overhung weight is introduced at quick-disconnect nut, and proceed as follows.					
	(4) As fuel pump is being installed, engage locking bolt into nut in bracket (or into nut in quick-disconnect nut, if applicable).					
	(5) As quick-disconnect nut locking bolt is tightened, use eight-ounce plastic mallet to tap quick-disconnect nut radially all around circumference of nut and circumfer-entially (in tightening					

REF NO.	DESCRIPTION	REF. DIMENSIONS MIN	REF. DIMENSIONS MAX	LIMITS MIN	LIMITS MAX	REPLACE IF OVER
(CONTINUED)						
	direction) at locking bolt location.					
	(6) Torque locking bolt to 65 - 85 lb - in.					
	(7) Run engine, then repeat torque procedure.					
1136	Gearbox Driveshaft	.0865	.0885			
	Gearbox Driveshaft Outer Adapter	.0935	.0955	.005	.009	.011
1149	Bolt	.4355	.4365			
	Acc. Drive Gearbox Cover Bushing	.4370	.4380	.0005	.0025	.003
1151	Bolt	.475	.477			
	Acc. Drive Gearbox Housing Bushing	.5093	.5103	.0323	.0353	.0353
1152	Bolt	.649	.651			
	Acc. Drive Gearbox Housing	.6835	.6845	.0325	.0355	.0355
1153	Bolt	.475	.477			
	Fan Discharge Inner Case Assy	.5013	.5023	.0243	.0273	.0273

ACCESSORY AND COMPONENT DRIVES GEARBOX
HOUSING SECTION - INSPECTION/CHECK-02

REF NO.	DESCRIPTION	REF. DIMENSIONS MIN	REF. DIMENSIONS MAX	LIMITS MIN	LIMITS MAX	REPLACE IF OVER
1157	Acc. Drive Gearbox Housing - Gearbox Lug Guide. Inner Face Must Be Tight To Gearbox Mating Face At Assy. Torque Bolts To Maintain This Condition.					
1158	Acc. Drive Gearbox Bracket Compr Case Bracket			.005	.015	
1160	Sleeve Bushing Pin			.007	.011	
1161	Acc. Drive Gearbox Mount Pin-Compr Case Sleeve			.0010	.004	
1162	Pin	.309	.311			
	Oil Tank Mount	.312	.322	.001	.013	.015
1424	Pin	.309	.311			
	Oil Tank Bracket	.313	.315	.002	.006	
1425	Stud	.245	.250			
	Oil Tank Mount	.252	.262	.002	.017	
1426	Stud	.299	.311			
	Oil Tank Mount	.313	.316	.002	.017	
1428	Bushing	.564	.565			
	Bracket	.561	.562	.002T	.004T	

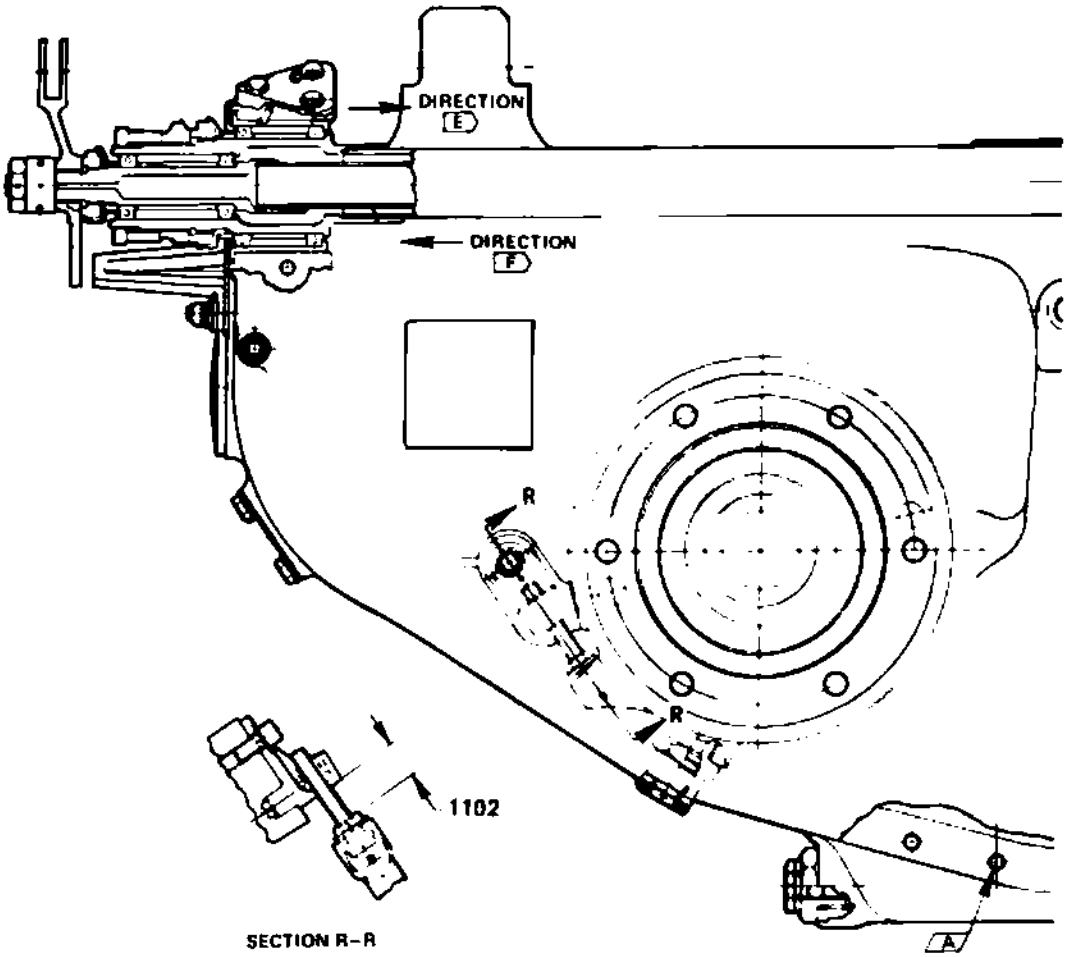
B. Special Torques

REF NO.	DESCRIPTION	LIMITS MIN	LIMITS MAX	REPLACE IF OVER
1460	Gearbox Assy Mount Lugs - Retaining Mount Nut	50	100	

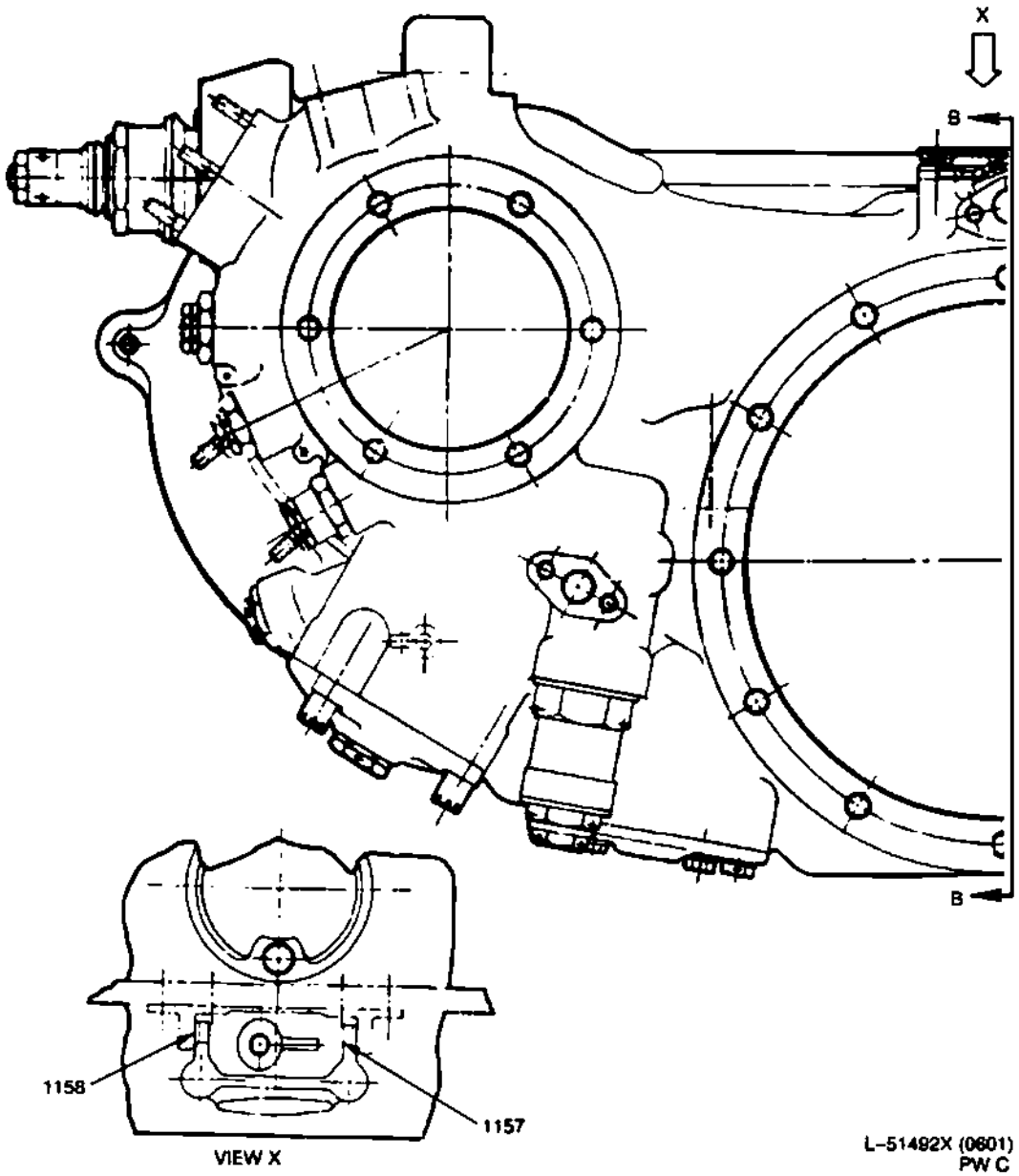
REF NO.	DESCRIPTION	LIMITS MIN	LIMITS MAX	REPLACE IF OVER
1475	Oil Tank Strap Retaining Nut - Tighten Until Just Before Nut Begins to Tighten Strap - Check Torque At This Point. Then Continue Tightening Until 3-5 Lb-In. Above Previously Checked Torque Is Reached. Bolt Threads Must Be Flush Or Protruded Above Locknut.			
1541	Oil Tank Cap Spring At 0.375 Inch	17.0	24.0	

C. Numerical Tool List

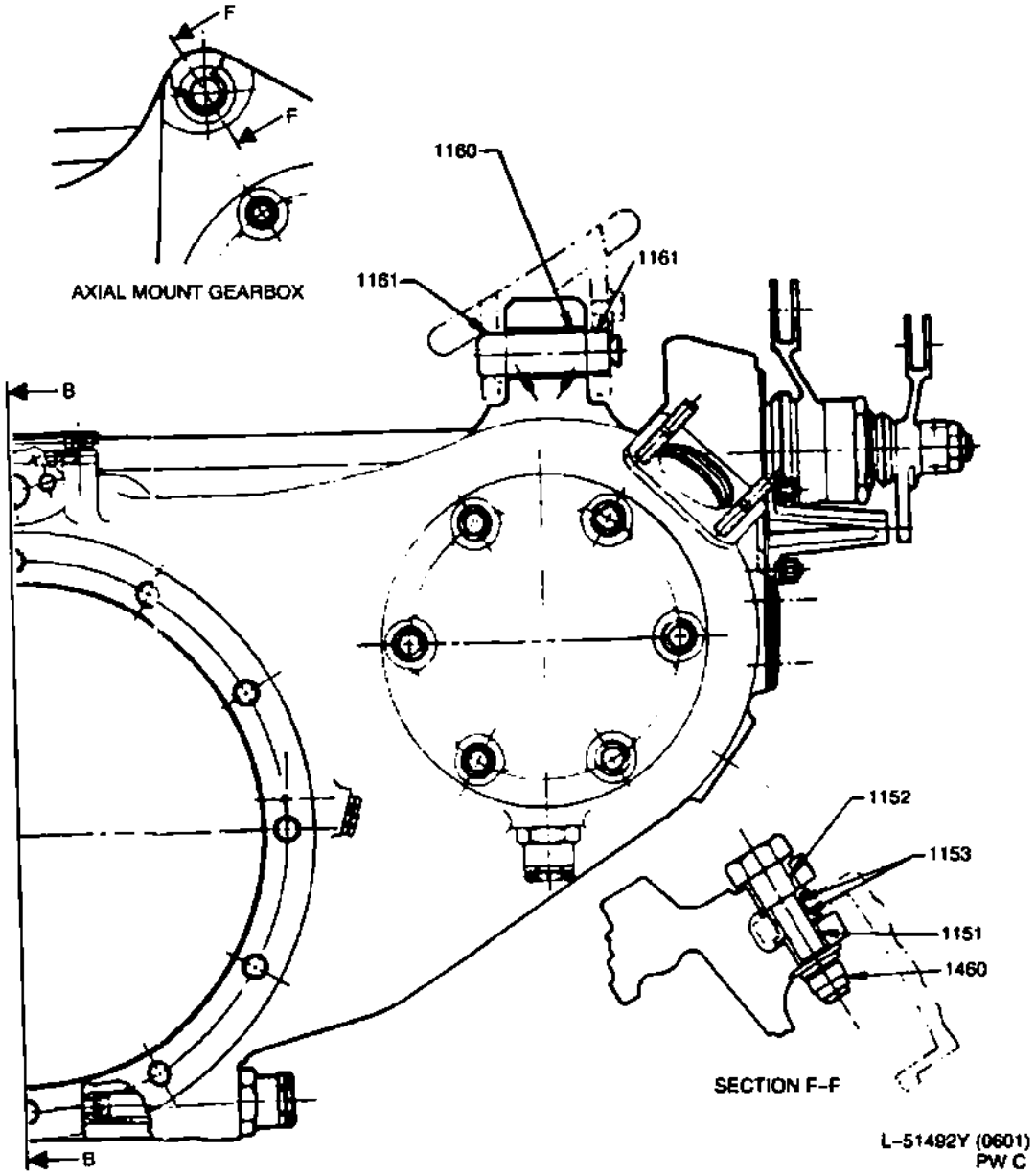
PWA 10408	Adapter
PWA 33713	Adapter - Fuel Pump Drive Concentricity And Squareness
PWA 33788	Gage - Hydraulic Pump Drive Concentricity And Squareness
PWA 33789	Gage - N2 Tachometer Drive Concentricity And Squareness



Accessory Drives
Section (1-6000A-69)
Figure 601 (Sheet 1)
(Task 72-60-00-990-008)

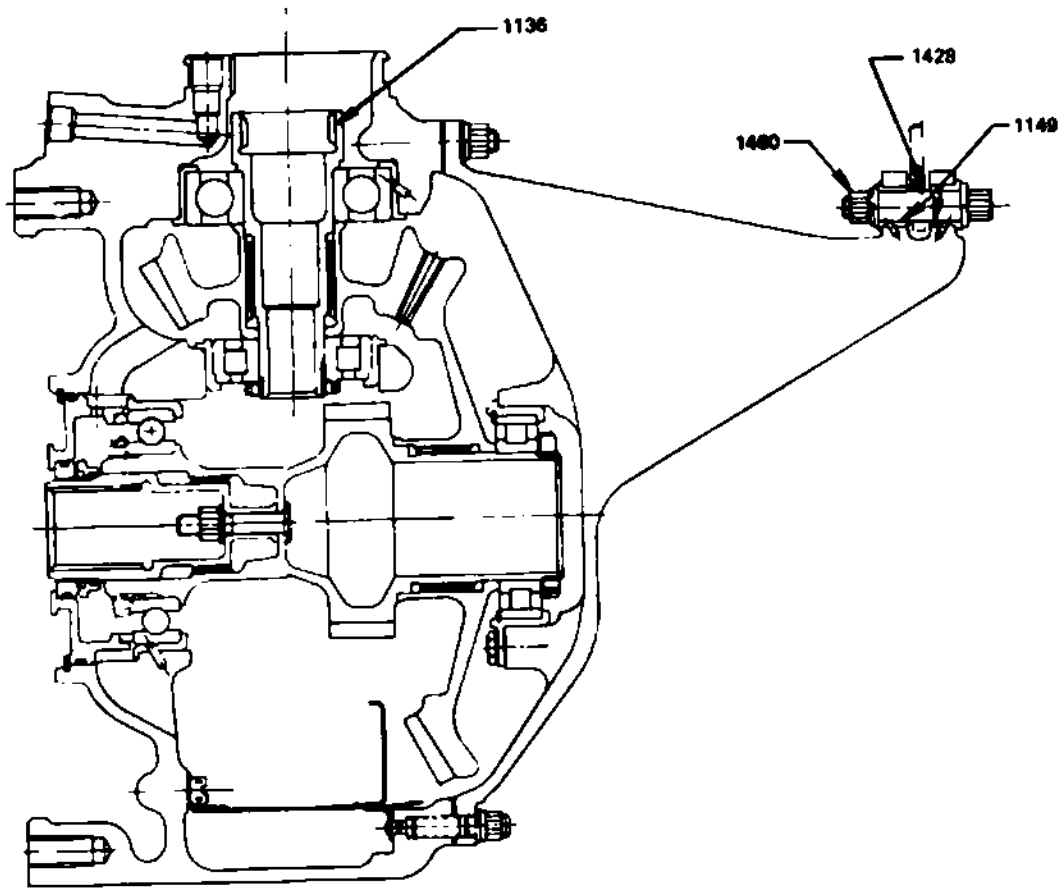


Accessory Drives
Section (1-0000Y-77)
Figure 601 (Sheet 2)
(Task 72-60-00-990-008)



Accessory Drives
Section (1-0000Y-77)
Figure 601 (Sheet 3)
(Task 72-60-00-990-008)

ACCESSORY AND COMPONENT DRIVES GEARBOX
HOUSING SECTION - INSPECTION/CHECK-02



SECTION B-B

1-0000 Z-69
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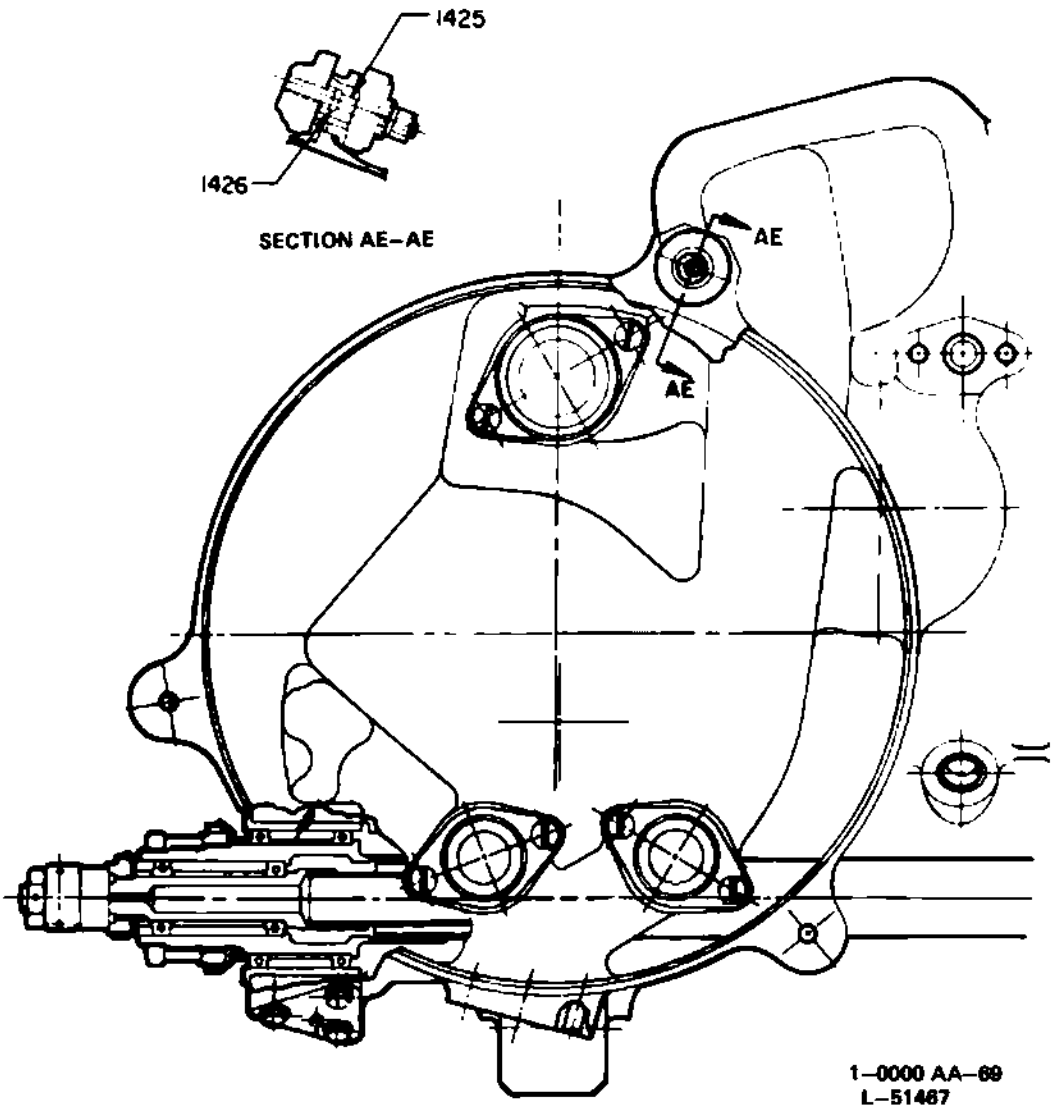
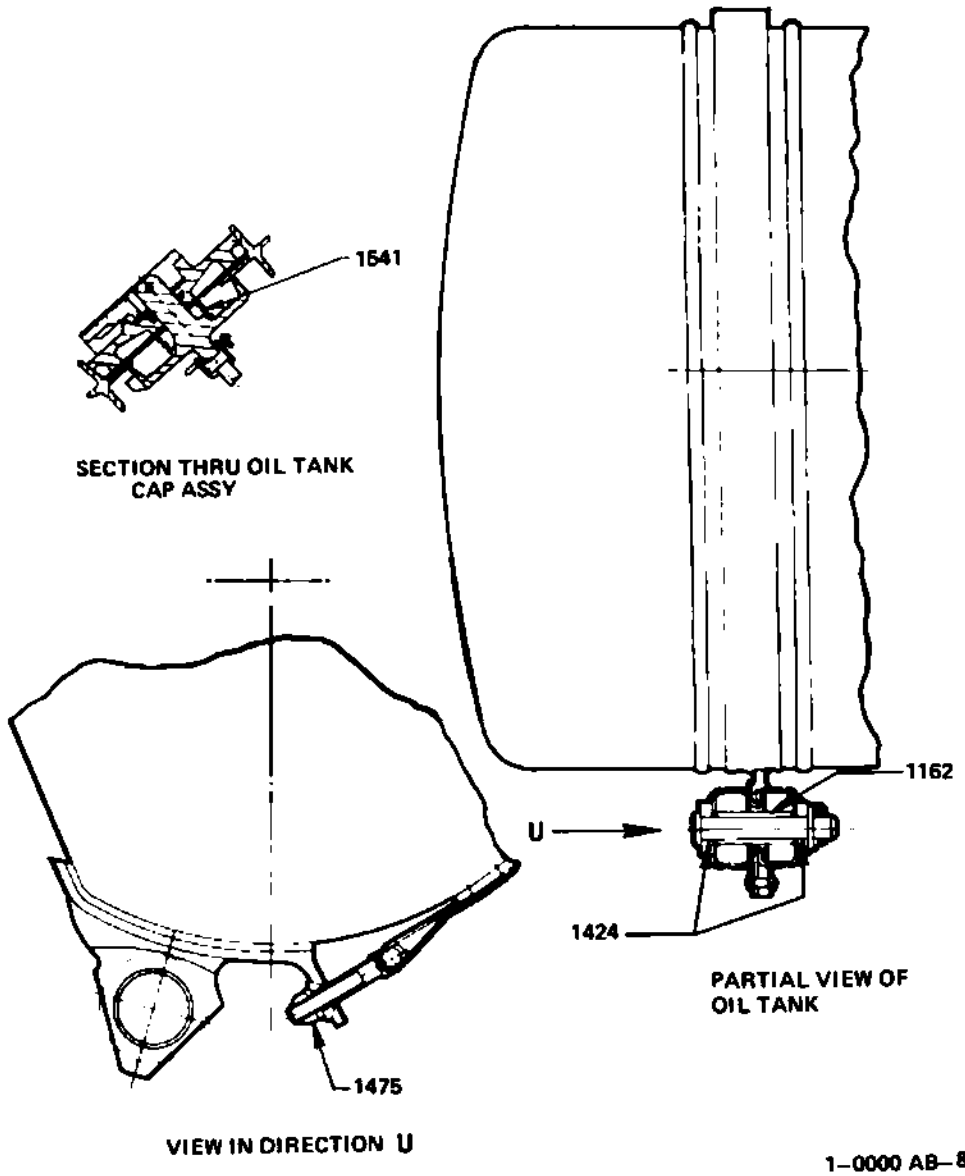


Accessory Drives
Section (1-0000AA-69)
Figure 601 (Sheet 5)
(Task 72-60-00-990-008)



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ACCESSORY AND COMPONENT DRIVES GEARBOX ASSEMBLY - REMOVAL/INSTALLATION-00

Task 72-61-00-430-001:

1. General

A. If gearbox removal is necessary, see Section 72-60-00, Removal/Installation-00.

B. Seal Disassembly/Reassembly (Demountable Type Only) See Figure 401.

(1) Disassemble seals of demountable type by removing retaining ring and pulling carbon element, preformed packing, washer, and wave washer from seal housing.

NOTE: To prevent damage to carbon seal element, depress element with fingers while disengaging retaining ring.

CAUTION: IN FOLLOWING CLEANING PROCEDURE DO NOT SCRAPE INSIDE OF SEAL HOUSING WITH ANY SHARP INSTRUMENT: HOUSING IS COATED WITH FLUOROCARBON PLASTIC WHICH WILL BE DAMAGED BY SCRAPING.

(2) Clean seal housing fully by SPOP 209. Clean other seal details by washing in clean engine oil. See Section 72-00-00, Cleaning-00.

(3) Assemble wave washer, new preformed packing, and carbon element inside seal housing and secure with retaining ring. Ensure that retaining ring (or snapring, as applicable) is fully engaged in seal housing.

NOTE: Seal details (wave washer, washer, carbon element, and retaining ring) are interchangeable only between seals of identical part number. Seal option number (e.g. PN 749834IC) will encompass several part numbers, for which details are not interchangeable. Detail parts of seal assemblies are color-coded to prevent improper parts mixing.

C. Reinstallation Of Seals

(1) Before installing carbon seals in any gearbox location, work seal thoroughly in engine oil to ensure free movement of carbon element. See Inspection/Check-00, Fits and Clearances, Reference Number 1429.

Task 72-61-00-430-002:

2. Starter Drive Oil Seal Replacement

A. Removal of Seal and Housing

(1) Remove starter, or drive pad cover, from gearbox.

(2) Remove drain plug and drain gearbox.

(3) Remove retaining ring securing starter drive seal housing in gearbox.

(4) Using PWA 12034 Puller, remove seal housing.

B. Seal Replacement

(1) Place seal housing into PWA 12036 Holder with seal facing down. Using PWA 12038 Drift, remove seal from seal housing.

(2) Using PWA 12918 Drift and PWA 10631 Base, install new seal in housing.

NOTE: Holder is not required for installing seal.

C. Installation of Seal and Housing

(1) Install new packing, lubricated with a thin layer of PWA 36500 Assembly Fluid, in OD groove of seal housing and install seal housing into starter drive opening in gearbox.

(2) Secure housing with retaining ring.

(3) Using new gasket reinstall starter (or pad cover) and secure.

(4) Install drain plug with new seal into gearbox. tighten to recommended torque and lockwire.

(5) Refill oil system to correct level.

Task 72-61-00-430-003:

3. Starter Drive Spline Adapter Removal/Installation

A. Starter Drive Spline Adapter Removal

(1) Remove starter, or starter drive pad cover, from rear face of accessory drives gearbox.

R (2) Remove the seal housing. Refer to Paragraph 2. (Task
R 72-61-00-430-002).

(3) Remove locknut from anchor bolt inside starter drive spline adapter.

(4) Insert PWA 3790-55 Puller into inner groove and remove worn or damaged spline adapter from starter drive gearshaft.

NOTE: If adapter has sheared inboard of spline section, remove remainder using PWA 10570 Puller. Position puller jaws behind ID flange and remove adapter with knocker action.

B. Starter Drive Spline Adapter Installation

(1) Install the new starter drive spline adapter into the splines of the starter drive gearshaft.

(2) Install the locknut inside the adapter and tighten to the recommended torque.

(3) Install the new seal and the seal housing. See Paragraph 2.

(4) Install the starter drive pad cover, secured with the washers and the nuts, or reinstall the starter. Tighten the nuts to the recommended torque.

Task 72-61-00-430-004:

4. Hydraulic Pump Drive Oil Seal Replacement

A. Removal of Seal and Housing

(1) Remove the hydraulic pump, or drive pad cover, from the gearbox.

(2) Remove drain plug and drain gearbox.

(3) Remove retaining ring securing hydraulic pump drive seal housing in the gearbox.

(4) Using PWA 12034 Puller, remove seal housing.

B. Seal Replacement

(1) Place seal housing into PWA 12036 Holder with seal facing down. Using PWA 12038 Drift, remove seal from seal housing.

(2) Using PWA 12918 Drift and PWA 10631 Base, install new seal in housing.

C. Installation of Seal and Housing

(1) Install a new packing, lubricated with a thin layer of PWA 36500 Assembly Fluid, in the OD groove of the seal housing and install the seal housing into the hydraulic pump drive opening in the gearbox.

(2) Secure the housing with the retaining ring.

(3) Using a new gasket, reinstall the hydraulic pump (or pad cover) and secure.

(4) Install the drain plug with a new seal into the gearbox, tighten to the recommended torque and lockwire.

(5) Refill the oil system to the correct level.

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Task 72-61-00-430-005:

5. CSD Oil Seal Replacement

A. Removal of Seal and Housing

(1) Remove CSD Alternator, or alternator drive pad cover, from the accessory drives gearbox.

(2) Remove drain plug and drain gearbox.

(3) Remove retaining ring securing seal housing in gearbox.

(4) Using PWA 12034 (formerly PWA 12103) Puller, remove seal housing from gearbox.

B. Seal Replacement

(1) Place seal housing into PWA 12036 Holder with seal facing down. Using PWA 12107 Drift, remove seal from seal housing.

(2) Using PWA 12108 Drift and PWA 10631 Base, install new seal in housing.

C. Installation of Seal and Housing

R (1) Install new packing, lubricated with a thin layer of
R PWA 36500 lubricant, in the OD groove of the seal
R housing and install the seal housing into the CSD
R opening in the gearbox. Secure the housing with the
R retaining ring.

(2) Using new gasket, reinstall CSD alternator (or pad cover) and secure.

(3) Install drain plug with new seal into gearbox, tighten to recommended torque and lockwire.

(4) Refill oil system to correct level.

Task 72-61-00-430-006:

6. Constant Speed Drive/Alternator Drive Coupling Replacement

A. Removal of Gearbox CSD Coupling

(1) Remove CSD alternator (or pad cover) from accessory drives gearbox.

(2) Remove retaining ring securing seal housing in gearbox.

(3) Remove seal and seal housing from gearbox. See Paragraph 5.

(4) Remove locknut which secures alternator drive coupling to gearshaft.

(5) Remove coupling from the gearshaft.

B. Installation Of Gearbox CSD Coupling
See Figure 402.

(1) If coupling is of lubricated-spline type (see figure), install new packing, lubricated with a thin layer of PWA 36500 Assembly Fluid in groove of coupling.

(2) Install coupling in end of CSD/alternator drive gearshaft, meshing OD spline of coupling with ID spline of gearshaft. Install locknut and torque to Fits and Clearances Reference 1449.

NOTE: Lubricated-spline coupling and gearshaft configuration has been replaced by later configuration which omits oil groove in ID of gearshaft (reference SB 2235). Later gearshaft (without oil groove) can be fitted with earlier type coupling (with packing groove), in which case packing may be omitted. Earlier type gearshaft (with oil groove) must be fitted with earlier type coupling, with packing installed.

NOTE: Gearshaft and coupling modified per SB 3404 will feature shouldered stud in ID of gearshaft and flat inner base on coupling. Install this type of coupling in same manner as unmodified couplings per steps (1) and (2). These couplings exist in both lubricated and non-lubricated spline type; interchangeability requirements for each type are as described in this note.

(3) Install new seal and housing into CSD opening in gearbox. See Paragraph 5.

(4) Secure housing with retaining ring.

(5) Using new gasket, reinstall CSD/alternator (or pad cover) and tighten bolts.

Task 72-61-00-430-007:

7. Fuel Pump Drive Oil Seal Replacement

A. Removal of Seal and Housing

(1) Remove fuel pump and control (together) from gearbox. See Chapter/Section 73-11-01, Removal/Installation-00.

(2) Remove drain plug and drain gearbox.

(3) Remove retaining ring securing seal housing then, using PWA 12033 Puller, remove seal housing from gearbox.

B. Seal Replacement

(1) Place seal housing in PWA 12036 Holder with seal facing down. Using PWA 12037 Drift, remove seal from seal housing.

(2) Using PWA 33608 Drift (for PN 749842, 749843 or 773980 Seal) or PWA 12039 Drift (for prior seal PN's), install new seal in housing.

C. Installation of Seal and Housing

R (1) Install a new packing, lubricated with a thin layer
R of PWA 36500 lubricant, in the OD groove of the seal
R housing and install the seal housing over the fuel pump
R drive gearshaft in the gearbox.

(2) Secure housing with retaining ring.

(3) Reinstall fuel pump and control together on gearbox. See Chapter/Section 73-11-01, Removal/Installation-00.

(4) Install drain plug with new seal into gearbox, torque and lockwire.

(5) Refill oil system to correct level.

Task 72-61-00-430-008:

8. Deoiler Seal Replacement - Gearboxes Incorporating Deoiler Carbon Seal Access Port (Post SB 4539)

See Figure 403.

A. Removal of Seal

NOTE: A gearbox post-SB 4539 has an external access plug on the front face of the gearbox where the oil tank is installed. There is a bolted plate behind the plug which it is possible to see through the breather passage. Replacement of the deoiler seal is possible after removal of the access plug and the bolted plate. If there is no access plug and bolted plate, the gearbox is pre-SB 4539, and replacement of the deoiler seal is not possible without gearbox disassembly.

(1) Remove oil tank. See Chapter/Section 79-11-01, Removal/Installation-00.

(2) Remove deoiler seal access port plug retaining ring.

(3) Remove access plug using PWA 3572 Puller.

(4) Remove the two screws or the three bolts that hold the retaining plate and remove the plate.

(5) Remove the deoiler seal as follows:

(a) If the plate removed in step (4) has three holes, use PWA 46103 Puller and do steps (c) thru (g).

(b) If the plate removed in step (4) has two holes, use PWA 33308 Puller and do steps (c) thru (g).

(c) Remove the large hex nut, washer and bung from the holder assembly.

(d) Loosen the expander rod nut to retract the segments of the puller.

(e) Position the puller on the seal, through the gearbox cover, and expand the segments with the expander rod and nut to make the segments engage the steel lip of the seal.

(f) Install the bung (small OD in) over the holder assembly so that it enters the gearbox cover bushing and install the washer and nut.

(g) Tighten the larger nut to remove the seal.

B. Installation of Seal

NOTE: Before installing carbon seal in any gearbox location, work seal thoroughly in engine oil to ensure free movement of carbon element. See Fits and Clearances, Reference 1429.

(1) Using PWA 33307 Drift install seal as shown in figure.

NOTE: Seal must fit firmly against inner face of retaining plate as shown.

(2) Install the retaining plate over the seal and attach it with two screws or three bolts. If two screws are used, safety the screws with lockwire.

NOTE: Double hex-head type screws shall be torqued to 13 - 14.5 lb-in.

(3) Install new packing (lubricated with a thin layer of PWA 36500 Lubricant in access port plug, and install plug in gearbox housing.

(4) Install access port plug retaining ring.

(5) Install oil tank. See Chapter/Section 79-11-01, Removal/Installation-00.

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Task 72-61-00-430-009:

9. Removal/Installation Of Main Oil Pump

A. Removal

CAUTION: IF THROUGH BOLTS ARE INADVERTENTLY REMOVED, LOCKWIRE MAY FALL INTO THE GEARBOX HOUSING. REMOVE ONLY BOLTS ON OUTER EDGE OF OIL PUMP COVER.

(1) Remove bolts and washers securing main oil pump to accessory drives gearbox.

(2) Separate oil pump from gearbox using standard jackscrews.

B. Installation

(1) Install new packings, lubricated with a thin layer of PWA 36500 Lubricant, in three OD grooves of pump assembly.

(2) Secure main oil pump to accessory drives gearbox with bolts and washers. Tighten bolts to recommended torque and lockwire.

Task 72-61-00-430-010:

10. Removal/Installation Of Main Oil Filter/Strainer

A. Removal

(1) Remove the (4) nuts and washers that attach the main oil filter/strainer cover to the accessory drive gearbox housing.

CAUTION: HOLD THE COVER WHILE THE NUTS ARE LOOSENED. WITH SOME STRAINER TYPES A SPRING BEHIND THE THE COVER CAN PUSH THE COVER OFF OF THE GEARBOX HOUSING AND CAUSE IT TO FALL ON THE GROUND.

(2) Remove the cover from the gearbox (with the filter element if applicable). Remove and discard the packing from the cover.

NOTE: There are three types of main oil filters/strainers in JT8D engines. Post-SB 3393/6209 engines have a disposable filter

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element which is installed on the pressure relief valve (which is attached to the cover). With this configuration, the filter element will usually come out with the cover and relief valve assembly (if not, pull the filter element out of the gearbox housing after the cover and relief valve have been removed). See Table 401.

NOTE: Pre-SB 3393/6209 engines may have a 175-micron filter strainer or a 40-micron strainer. A spring keeps these strainers tight against the filter housing cavity. Carefully remove the strainer element from the gearbox housing after the cover is removed. See Table 401.

FILTER/STRAINER	RATING	DESCRIPTION
Filter	40 Nominal/ 70 Absolute	Post-SB 6209 (Disposable)
Filter	15 Nominal/ 30 Absolute	Post-SB 3393 (Disposable)
Strainer	40 Nominal/ 70 Absolute	Basic Configuration (Cleanable)
Strainer	175 Absolute	Basic Configuation (Screen and Spcaer (Cleanable)

Table 401

(3) Remove the filter or strainer element from the gearbox housing if it does not come out with the cover assembly.

R (4) For a 175-micron strainer: It is possible to
R disassemble the strainer for cleaning. Refer to
R Section 72-61-53, Maintenance Practices-00 (Task
R 72-61-53-430-001) and Cleaning/Painting-00 (Task
R 72-61-53-110-001).

R (5) For a 40-micron strainer: It is possible to
R disassemble the strainer for cleaning. Refer to
R Section 72-61-53, Maintenance Practices-00 (Task
R 72-61-53-430-001) and Cleaning/Painting-00 (Task
72-61-53-110-001).

(6) For post-SB 3393/6209 15 or 40-micron filters: These filters are disposable only. Do not clean them. The pressure relief valve for these filters stays with
R the cover. Refer to Section 72-61-53, Maintenance
R Practices-00 (Task 72-61-53-430-001) for disassembly procedures.

B. Installation

(1) For a 175-micron strainer: Make sure that the strainer, cover and spring are fully assembled. Refer to Section 72-61-53, Maintenance Practices (Task 72-61-53-430-001).

(2) For a 40-micron strainer: Make sure that the strainer, cover and spring are fully assembled. Refer to Section 72-61-53, Maintenance Practices (Task 72-61-53-430-001).

CAUTION: A PACKING IS LOCATED BETWEEN THE FILTER ELEMENT AND THE PRESSURE RELIEF VALVE OF THE 15 OR 40 MICRON DISPOSABLE FILTER. (SEE FIGURE 405.) MAKE SURE THAT THIS PACKING IS IN ITS CORRECT POSITION AND IS NOT TWISTED OR CUT.

(3) For 15 or 40-micron filters: Make sure that the filter and pressure relief valve are fully assembled and installed on the cover. Refer to Section 72-61-53, Maintenance Practices (Task 72-61-53-430-001).

(4) Carefully install a new packing lubricated with PWA 36500 lubricant against the shoulder of the oil filter/strainer housing cover. Make sure that the packing seats against the flange of the oil filter/strainer housing cover. See Figure 406. Also apply lubricant to the mating surface of the gearbox filter/stainer recess where the cover will go.

NOTE: Post SB 6424 main oil filter cover packings have an oval shape that will help to seal oil in the filter housing. Again, make sure that the packing (Pre or Post SB 6424) is tightly installed against the cover flange shoulder as shown in Figure 406. Make sure that the the packing is not twisted or out of position when installing it on the cover. Make sure that the

packing is installed correctly before installing the oil filter housing cover.

(5) Install the 175 or 40 micron strainer: Install the strainer element in the gearbox oil filter housing with the center nut pointed out-away from the engine. Install the oil filter housing cover with its spring against the strainer element and push the cover fully into position. Align the cover holes with the studs.

(6) Install the 15 or 40 micron filter: Install the filter, pressure relief valve, and oil filter housing cover on the gearbox oil filter housing. Push the cover/filter assembly fully into position. Align the cover holes with the studs.

CAUTION: DO NOT PUT MORE THAN THE SPECIFIED TORQUE ON THE COVER NUTS. TOO MUCH TORQUE CAN CAUSE DAMAGE TO THE STUDS AND CAN CAUSE THE COVER TO LEAK.

(7) Attach the cover to the gearbox with (4) washers and (4) nuts. Torque the nuts as follows:

(a) When you use PN 640232 and prior locknuts: Torque them to 80 - 100 lb-in. (9.039 - 11.298 N.m).

(b) When you use PN 670862 round nuts or prior sleeve nuts: Torque them to 25 - 30 lb-in. (2.825 - 3.390 N.m).

NOTE: If an engine has PN 653067 sleeve nuts (refer to SB 2187) that do not cause interference with engine cowling parts, it is permitted to continue these sleeve nuts and washers in service.

(c) Safety round nuts or sleeve nuts with lockwire.

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Task 72-61-00-430-011:

11. Removal/Installation of the Oil Pressure Relief Valve

A. Removal

CAUTION: PROTECT PERSONNEL AND EQUIPMENT FROM SPILLED OIL DURING REMOVAL OF THE PRESSURE RELIEF VALVE (OIL CAN FLOW FROM THE VALVE PORT AND IF IT IS HOT THIS CAN CAUSE BURNS). HOLD A CONTAINER OF SUFFICIENT SIZE UNDER THE GEARBOX VALVE PORT DURING VALVE REMOVAL.

(1) Remove oil pressure relief valve from gearbox.

B. Installation

(1) Install lubricated packing in each groove and next to flange at thread of pressure relief valve assembly.

NOTE: For gearboxes equipped with threaded insert in relief valve port, use large OD packing, PN 401112 or MS 9388-220, next to flange on relief valve housing.

(2) Install pressure relief valve assembly into relief valve port of gearbox and torque to Inspection/Check-00, Fits and Clearances Reference Number 1461. Lockwire valve housing to gearbox.

(3) If Service Bulletin No. 1132 has been accomplished, modify a Proto deep socket or equivalent to torque relief valve assembly as follows:

(a) Rework No. 5548HL, 1 1/2 inch six point Proto deep socket or equivalent to an ID of 1.610 inch for a length of 2.1875 inch and an OD of 1.930 inch for its full length.

(b) Torque and lockwire relief valve housing as described in previous step.

NOTE: If the referenced Service Bulletin has not been accomplished, it can be done with a hand power tool and rotary file.

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Task 72-61-00-430-012:

12. N2 Tachometer Drive Gearshaft Seal Replacement

See Figure 404.

A. Removal of Seal and Housing

(1) Remove nuts and washers then remove tachometer generator or tachometer drive pad cover from gearbox.

(2) Remove snapring.

(3) Using PWA 9519 Puller, remove tachometer gearshaft drive seal housing from accessory drives gearbox housing.

B. Seal Replacement

(1) Remove seal from the seal housing.

(2) Position seal housing into counterbore of PWA 12542 Base.

(3) Position seal on PWA 12541 Drift and drift on base, piloting on small ID of base.

(4) Using arbor press install seal.

NOTE: Install seal in housing, steel casing down so that coil spring faces into gearbox when installed.

C. Installation of Seal and Housing

(1) Install new packing, lubricated with a thin layer of PWA 36500 Lubricant, on seal housing.

(2) Position assembled seal and housing over PWA 10016 Guide and install (metal side of seal outward) into assembled shaft and housing.

(3) Tap to seat and secure with snapring.

(4) Using new gasket, reinstall the tachometer generator or tachometer drive pad cover and secure with washers and nuts.

(5) Tighten nuts to recommended torque.

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Task 72-61-00-430-013:

13. Fuel Pump Rear Coupling Replacement

A. Removal

NOTE: For removal and installation of the front coupling and quick-disconnect nut from the fuel pump, refer to Task 73-11-01-450-001 (Chapter/Section 73-11-01, Removal/Installation-00).

CAUTION: BE CAREFUL DURING LOCK REMOVAL NOT TO CAUSE DAMAGE TO THE COUPLING OR GEARBOX PAD SURFACE.

(1) Post-SB 2660: Use a small prybar to lift off and remove the locks from the six bolts that attach the rear coupling to the fuel pump pad of the gearbox. Discard the locks.

(2) Remove the six bolts that attach the coupling and remove the coupling from the gearbox fuel pump pad.

(3) If necessary remove the bracket from the face of the gearbox fuel pump pad.

B. Installation

(1) Install the rear coupling against the fuel pump pad of the gearbox. Align the six bolt holes of the coupling with the holes in the pad.

(2) Install six bolts to attach the coupling to the fuel pump pad and torque the bolts to the recommended torque.

(3) Post-SB 2660: Install a lock on each bolt as shown in Figure 407.

(a) Put a lock in position on the end of a bolt as shown in the figure.

(b) Put PWA 14152 Drift on the end of the bolthead and hit it with a fiber mallet to push the lock down around the points of the bolthead.

NOTE: If pushed down as far as it will go, the spring tension of the lock will hold it against the face of the coupling. Keep the edge of each lock against the wall of the coupling as shown.

(c) Install a lock on each of the remaining bolts with the same procedure.

(4) If the fuel pump coupling bracket was removed, install it as shown in the figure and attach it with a bolt torqued to the recommended torque.

Task 72-61-00-990-001:

14. Numerical Tool List

A. Removal

PWA 3572	Puller - Deoiler Seal Access Plug
PWA 3790-55	Puller - Starter Drive Adapter
PWA 6841	Drift - Tachometer Drive Seal (Superseded by PWA 12541)
PWA 9519	Puller - N2 Tachometer Drive Seal Housing
PWA 10016	Guide - Tachometer Drive Seal (Supersedes PWA 14047)
PWA 10570	Puller - Starter Drive Adapter
PWA 10631	Base - Starter Drive Seal (Use With PWA 12918)
PWA 12033	Puller - Fuel Pump Drive Oil Seal Housing
PWA 12034	Puller - Starter/Accessory Drive Gearshaft Seal Housing (Superseded by PWA 12103)
PWA 12035	Puller - Accessory Drive (CSD) Gearshaft Seal Housing (Superseded by PWA 12103)
PWA 12036	Holder - Seal Housing Disassembly
PWA 12037	Drift - Fuel Pump Drive Oil Seal Housing
PWA 12038	Drift - Starter/Accessory Drive Gearshaft Seal Housing (Superseded by PWA 12107)
PWA 12039	Drift - Fuel Pump Drive Oil Seal Housing
PWA 12103	Puller - Starter/Accessory Drive Gearshaft Seal Housing (Supersedes PWA 12034 and 12035)
PWA 12107	Drift - Accessory Drive Gearshaft Seal
PWA 12108	Drift - Alternator Drive Oil Seal Housing
PWA 12541	Drift - Tachometer Shaft Seal (Supersedes

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R

(CONTINUED)

	PWA 6841)
PWA 12542	Base - Tachometer Shaft Seal Housing
PWA 12918	Drift - Starter/Accessory Drive Gearshaft Seal
PWA 14047	Guide - N2 Tachometer Drive Seal (Superseded by PWA 10016)
PWA 14152	Drift - Fuel Pump Rear Coupling Bolt Lock
PWA 33307	Drift - Deoiler Seal
PWA 33308	Puller - Deoiler Seal
PWA 33608	Drift - Fuel Pump Drive Oil Seal
PWA 46103	Puller - Deoiler Seal

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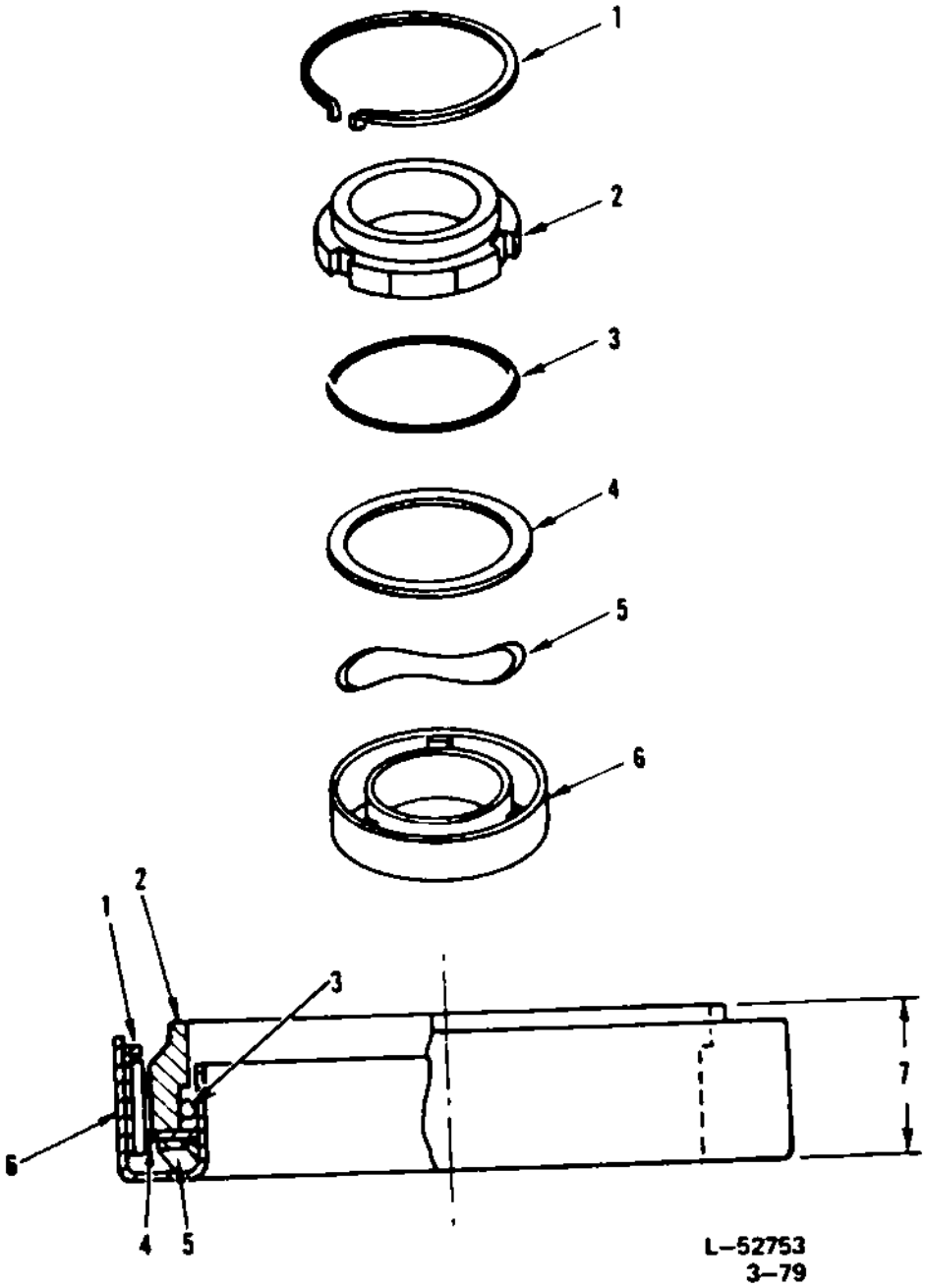

R Demountable Gearbox Seal Assembly
R Figure 401 #72-61-00
(Task 72-61-00-990-001) REM/INST-00
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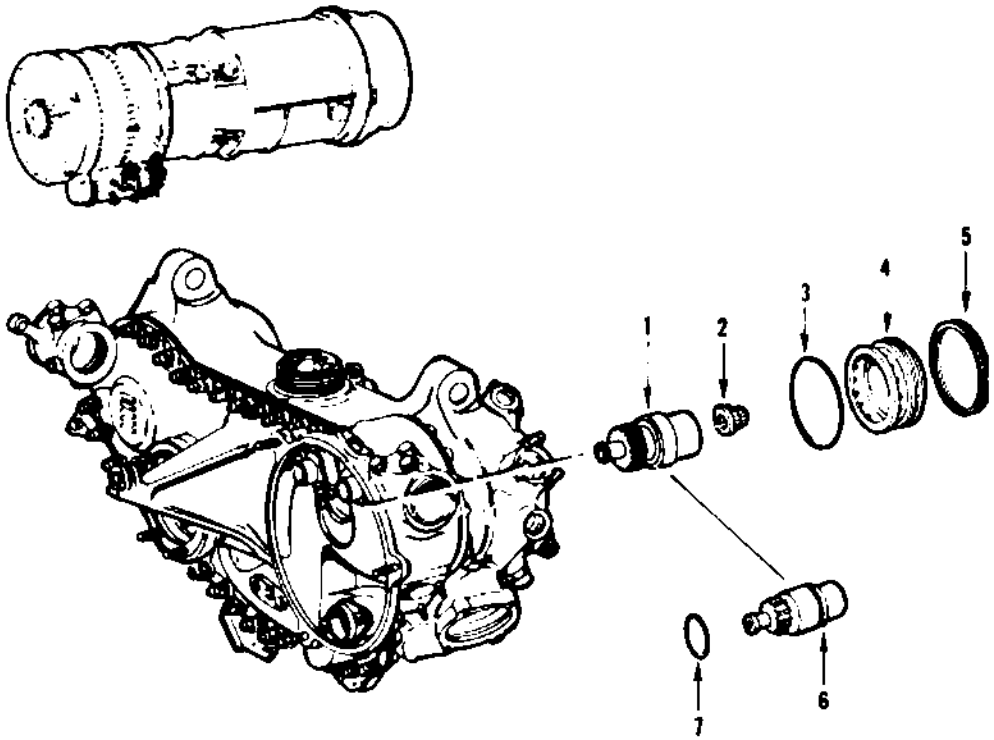
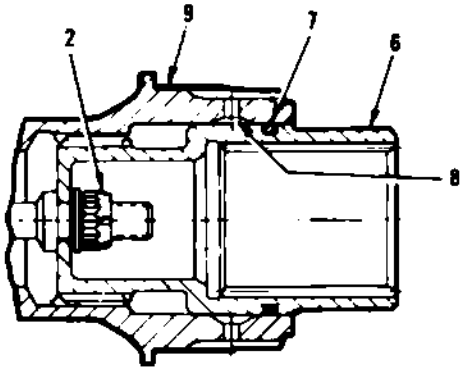
200

1. Retaining Ring
2. Carbon Seal Element
3. Preformed Packing
4. Washer
5. Wave Washer
6. Seal Housing
7. Fuel Pump Drive Spur Gearshaft Seal (PN 749842,749843, 773980,803646,803647) 0.730 Inch Minimum. Hydraulic Pump Drive Gearshaft Seal And Starter Drive Gearshaft Seal (PN 749838,749839,767919,773982,773983,803687,803688) 0.725 Inch Minimum. Impeller Seal (PN 749832,749833, 773979,774337,803643,803644) 0.670 Inch Minimum. Accessory And Component Drive Spur Gearshaft Seal (PN 749835,749836,773984,803690,803691) 0.725 Inch Minimum.

Key to Figure 401





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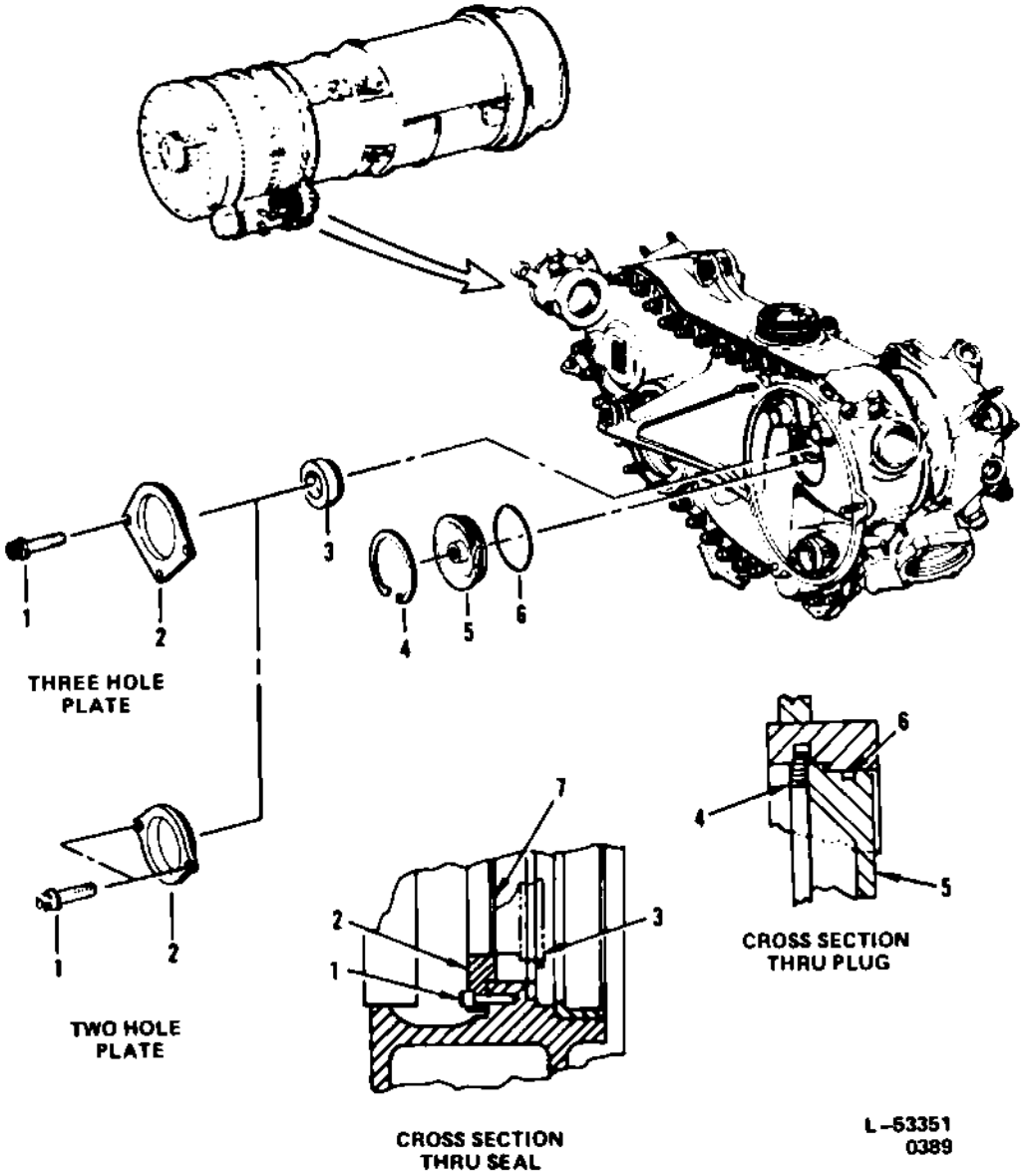
CROSS SECTION THRU REAR OF GEARSHAFT
(SHOWING LUBRICATED-SPLINE CONFIGURATION)

1. Gearshaft Coupling (Current Type)
2. Nut
3. Packing
4. Gearshaft Seal And Housing Assembly
5. Seal Housing Retaining Ring
6. Gearshaft Coupling (Lubricated-Spline Type)
7. Packing (For Use With Index 6 Coupling - See Text)
8. Oil Groove In Gearshaft ID (Reference)
9. Gearshaft Rear End (Reference)

Key to Figure 402


1
2
3
4
5
6
THREE HOLE PLATE
1
2
TWO HOLE PLATE
7
2
3
1
CROSS SECTION THRU SEAL
6
4
5
CROSS SECTION THRU PLUG
L-53351
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1. Screw (Two Required) Or Bolt (Three Required)
2. Retaining Plate (Two Or Three Hole)
3. Deoiler Seal
4. Snapring
5. Plug
6. Preformed Packing
7. Seal Must Bottom On This Surface
   (Inner Face Of Index 4 Plate)

Key to Figure 403

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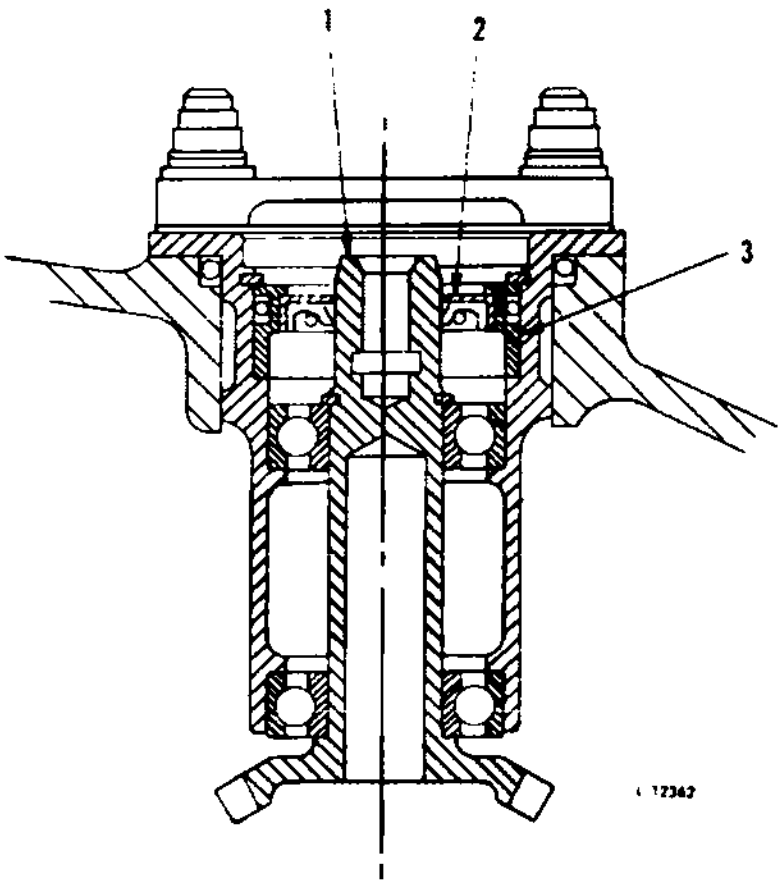
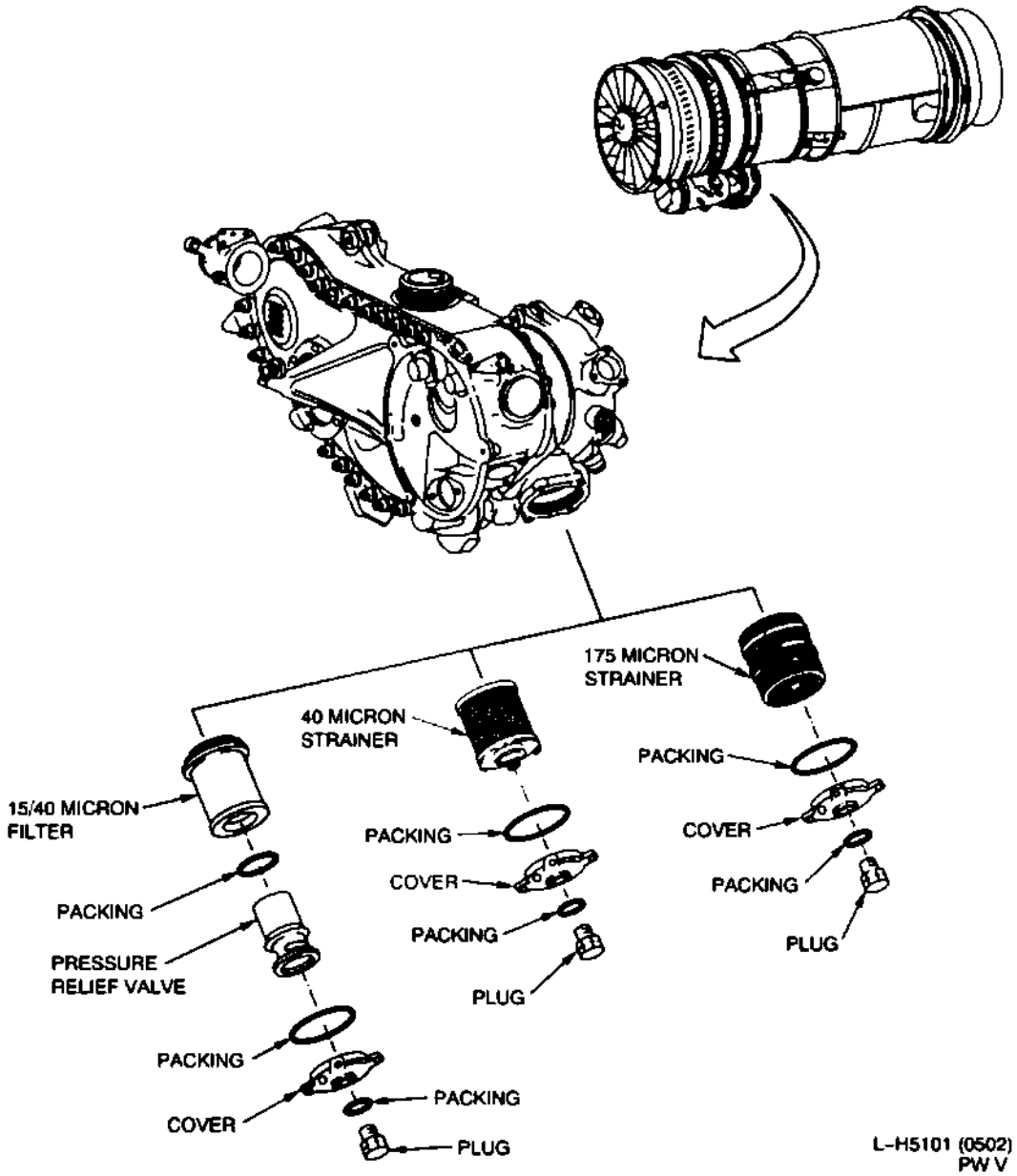
R

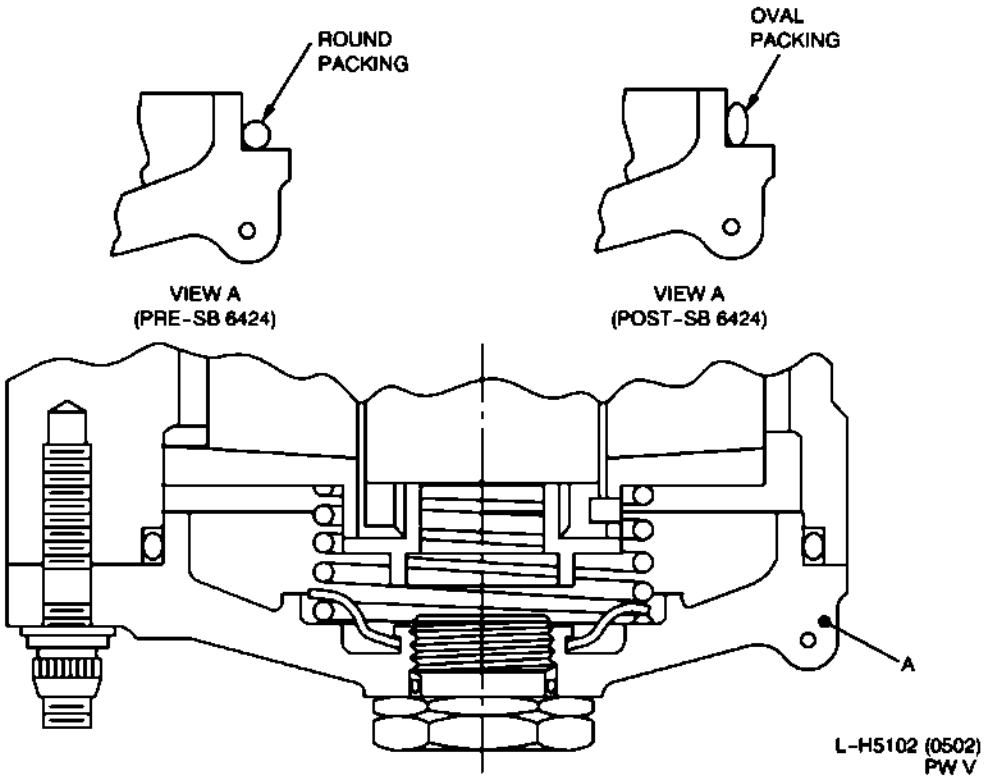


1. Tachometer Drive Gearshaft
2. Oil Seal
3. Oil Seal Housing

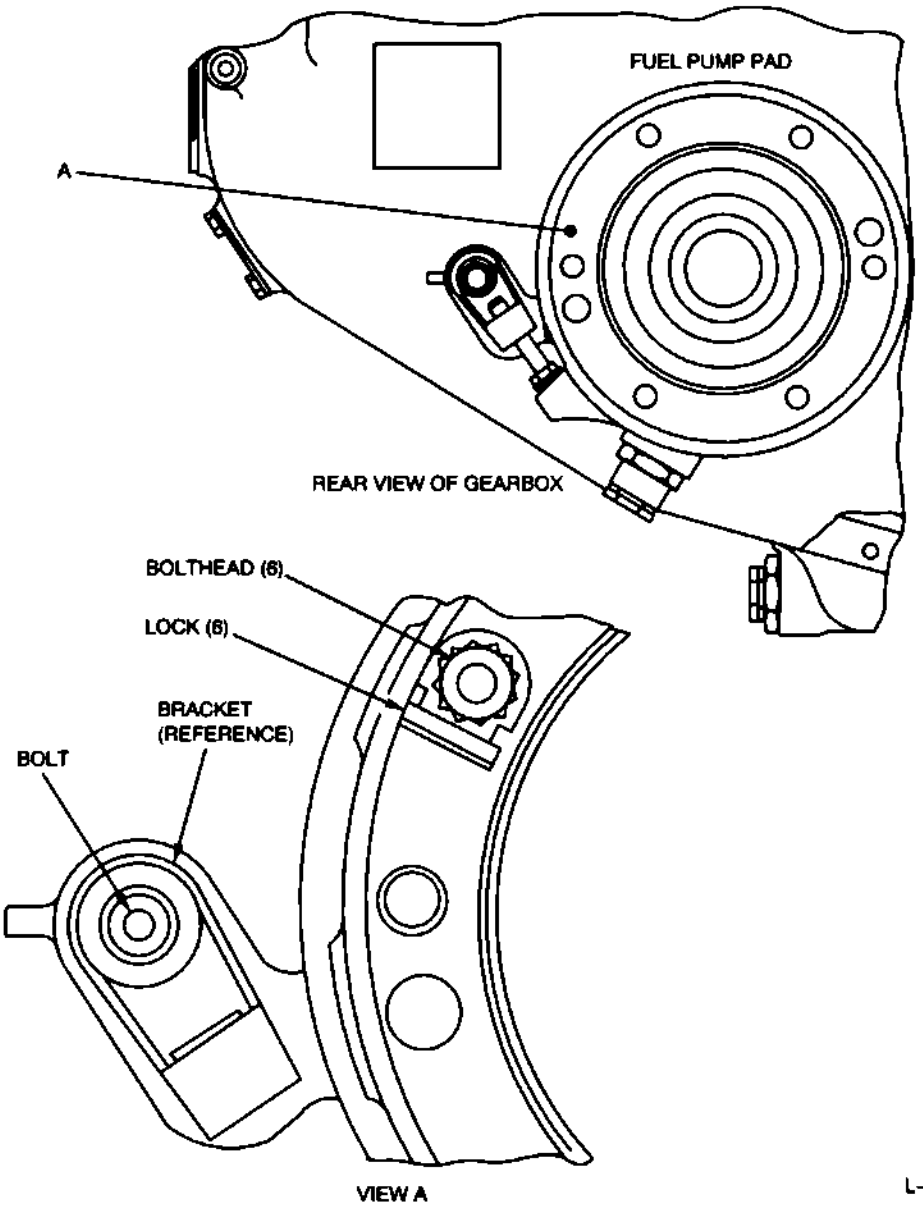
R N2 Tachometer Drive Gear
R Figure 404
(Task 72-61-00-990-001)



R Filter/Strainer Packing Locations
R Figure 405
(Task 72-61-00-990-001)



R Filter Housing Cover
R Packing Location
Figure 406
(Task 72-61-00-990-001)



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ACCESSORY AND COMPONENT DRIVES GEARBOX
ASSEMBLY - INSPECTION/CHECK-00

Task 72-61-00-990-002:

1. Accessory And Component Drives Gearbox Assembly

See Figure 601.

A. Fits and Clearances (For General Information, See 72-00-00, ENGINE - REMOVAL/INSTALLATION)

REF. NO.	DESCRIPTION	REF. DIMENSIONS MIN	REF. DIMENSIONS MAX	LIMITS MIN	LIMITS MAX	REPLACE IF OVER
1001	Oil Pressure Relief Valve Housing	.9325	.9365			
	Gearbox Housing	.944	.945	.0075	.0125	
1002	Oil Pressure Relief Valve Housing	1.316	1.320			
	Gearbox Housing	1.3275	1.3285	.0075	.0125	
1003	Oil Pressure Relief Valve Housing	1.363	1.367			
	Gearbox Housing	1.3745	1.3755	.0075	.0125	
1004	Oil Pressure Relief Valve Housing	1.3985	1.4025			
	Gearbox Housing	1.410	1.411	.0075	.0125	
1010	Gearbox Outer Cross Shaft Axial Motion			.003	.010	.012
1058	Outer Cover and Pump Housing	3.2580	3.2590			
	Housing Acc. Drives	3.2595	3.2605	.0005	.0025	.0035

ACCESSORY AND COMPONENT DRIVES GEARBOX
ASSEMBLY - INSPECTION/CHECK-00

REF. NO.	DESCRIPTION	REF. DIMENSIONS MIN	REF. DIMENSIONS MAX	LIMITS MIN	LIMITS MAX	REPLACE IF OVER
1070	Oil Pump Spacer Inner Cover	3.2580	3.2590			
	Housing Acc. Drives	3.2595	3.2605	.0005	.0025	.0035
1084	Dowel Pin	.24975	.25025			
	Oil Pump Outer Cover	.251	.252	.00075	.00225	.0025
1093	Tachometer Drive Gearshaft Bearing Housing	1.7485	1.7495			
	Acc. Drive Housing	1.7495	1.7505	.000	.002	.002
1096	Ball Bearing (OD)	1.999	2.000			
	Power Lever Sleeve Bushing	2.000	2.001	.000	.002	.0022
	Teflon Bearing OD PN's 706106A and 709676A and later	1.9960	1.9975			
	Power Lever Sleeve Bushing	2.000	2.001	.0025	.005	.005
	Teflon Bearing OD Prior to above	1.998	1.999			
	Power Lever Sleeve Bushing	2.000	2.001	.001	.003	.003
1100	Power Lever Cross Shaft Outer	.0466	.0476			
	Linkage Arm Fuel Control (Splines)	.0490	.0501	.0015	.0035	.0045

ACCESSORY AND COMPONENT DRIVES GEARBOX
ASSEMBLY - INSPECTION/CHECK-00

REF. NO.	DESCRIPTION	REF. DIMENSIONS MIN	REF. DIMENSIONS MAX	LIMITS MIN	LIMITS MAX	REPLACE IF OVER
1101	Power Lever Cross Shaft Inner Linkage Arm Shutoff (Splines)	.0465 .0490	.0475 .0500	 .0015	 .0035	 .0045
1104	Gearbox Drive Lower Bearing Bushing	2.632	2.633			
	Acc. Drive Gearbox Housing	2.633	2.634	.000	.002	.003
1105	Acc. Drive Front Bearing Bushing	3.345	3.346			
	Acc. Drive Gearbox Cover	3.346	3.347	.000	.002	.003
1106	Seal	2.876	2.878			
	Acc. Drive Gearbox Cover	2.870	2.872	.004T	.008T	.002T
1107	Bearing Starter Drive Front Bearing	3.5430	3.5433			
	Bushing	3.5433	3.5439	.0000	.0009	.0019
1109	Bearing Starter Drive Rear Bearing	3.1493	3.1496			
	Bushing	3.1496	3.1502	.0000	.0009	.0019
1110	Starter Drive Spur Gearshaft	2.1646	2.1650			
	Bearing	2.1651	2.1654	.0001	.0008	.0008

ACCESSORY AND COMPONENT DRIVES GEARBOX
ASSEMBLY - INSPECTION/CHECK-00

REF. NO.	DESCRIPTION	REF. DIMENSIONS MIN	REF. DIMENSIONS MAX	LIMITS MIN	LIMITS MAX	REPLACE IF OVER
1111	Seal Starter Drive Gearshaft Seal Housing	2.251 2.248	2.253 2.249	 .002T	 .005T	 .002T
1116	Bearing Gearbox Drive Front Bearing Bushing	2.9525 2.9528	2.9528 2.9534	 .0000	 .0009	 .0017
1118	Bearing Gearbox Drive Rear Bearing Bushing	2.8343 2.8346	2.8346 2.8352	 .000	 .0009	 .0017
1120	Bearing Acc. Drive Gearshaft Front Bearing Bushing	3.1493 3.1496	3.1496 3.1502	 .0000	 .0009	 .0017
1125	Acc. Drive Gearbox Gearshaft Gearshaft Bearing	2.1646 2.1651	2.1650 2.1654	 .0001	 .0008	 .0008
1126	Bearing Acc. Drive Gearshaft Rear Bearing Bushing	3.5430 3.5433	3.5433 3.5439	 .0000	 .0009	 .0017
1128	Seal Acc. Drive Gearshaft Seal Housing	2.3135 2.3105	2.3155 1.3115	 .002T	 .005T	 .002T
1129	Gearbox Driveshaft Outer Adapter Bearing	 .9845 .9841	 .9848 .9843	 .0002T	 .0007T	 *

ACCESSORY AND COMPONENT DRIVES GEARBOX ASSEMBLY - INSPECTION/CHECK-00

REF. NO.	DESCRIPTION	REF. DIMENSIONS MIN	REF. DIMENSIONS MAX	LIMITS MIN	LIMITS MAX	REPLACE IF OVER
1130	Bearing Gearbox Drive Lower Bearings	2.4406	2.4409			
	Bushing	2.4409	2.4415	.0000	.0009	.0017
1131	Gearbox Driveshaft Outer					
	Adapter	.996	.997			
	Gear Bevel	.9945	.9955	.0005T	.0025T	.0002T
1132	Gearbox Driveshaft Outer					
	Adapter	1.374	1.375			
	Gear Bevel	1.3725	1.3735	.0005T	.0025T	.0002T
1133	Gearbox Driveshaft Outer					
	Adapter	.0760	.0770			
	Gear Bevel (Spline)	.0785	.0795	.0015	.0035	.0055
1134	Bearing Gearbox Drive Upper Bearing	3.1493	3.1496			
	Bushing	3.1496	3.1502	.0000	.0009	.0017
1135	Gearbox Driveshaft Outer					
	Adapter	1.3781	1.3785			
	Bearing	1.3778	1.3780	.0001T	.0007T	*
1137	Seal Fuel Pump Drive Gearshaft	2.126	2.128			
	Seal Housing	2.123	2.124	.002T	.005T	.002T
1139	Bearing Fuel Pump Drive Front Bearing	2.6769	2.6772			
	Bushing	2.6772	2.6778	.0000	.0009	.0019

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ACCESSORY AND COMPONENT DRIVES GEARBOX
ASSEMBLY - INSPECTION/CHECK-00

REF. NO.	DESCRIPTION	REF. DIMENSIONS MIN	REF. DIMENSIONS MAX	LIMITS MIN	LIMITS MAX	REPLACE IF OVER
1142	Bearing Fuel Pump Drive Rear Bearing	2.4406	2.4409			
	Bushing	2.4409	2.4415	.0000	.0009	.0019
1143	Bearing Acc. Drive Gearshaft Front Bearing	2.4406	2.4409			
	Bushing	2.4409	2.4415	.0000	.0009	.0019
1146	Bearing Acc. Drive Gearshaft Rear Bearing	2.8343	2.8346			
	Bushing	2.8346	2.8352	.0000	.0009	.0019
1147	Seal Acc. Drive Gearshaft Seal	2.251	2.253			
	Housing	2.248	2.249	.002T	.005T	.002T
1148	Drive Pad Bracket Acc. Drive Gearbox	.3730	.3740			
	Cover	.3745	.3755	.0005	.0025	.003
1150	Bolt Bracket (PN 500438,	.4355	.4365			
	597753)	.437	.438	.005	.0025	.003
	Bracket Bushing (Bracket					
	PN 648960)	.437	.439	.0005	.0035	.004
1402	Oil Pump Drive Gearshaft Bevel Acc. Drive Gearshaft Bevel					
	(Backlash)			.0133	.0469	

ACCESSORY AND COMPONENT DRIVES GEARBOX
ASSEMBLY - INSPECTION/CHECK-00

REF. NO.	DESCRIPTION	REF. DIMENSIONS MIN	REF. DIMENSIONS MAX	LIMITS MIN	LIMITS MAX	REPLACE IF OVER
1403	Tachometer Drive Gearshaft Bevel Gearbox Drive Bevel (Backlash)			.011	.041	
1404	Acc. Drive Gearshaft Spur Gearbox Drive Gear Spur (Backlash)			.004	.020	
1405	Acc. Drive Gearbox Gearshaft Spur - Fuel Pump Drive Gearshaft Spur (Backlash)			.004	.020	
1406	Acc. Drive Bevel - Gearbox Drivegear Bevel (Backlash)			.007		
1407	Acc. Drive Gearshaft Spur - Gearbox Drive Gearshaft Spur (Backlash)			.004	.020	
1408	Gearbox Drive Gearshaft Spur - Starter Drive Gearshaft Spur (Backlash)			.004	.020	
1409	Gearbox Oil Tube Assy Gearbox Rear Housing			.010	.030	.033
1410	Conn Tube Gearbox Tube Oil Gearbox, Assy of			.002	.010	.013

ACCESSORY AND COMPONENT DRIVES GEARBOX
ASSEMBLY - INSPECTION/CHECK-00

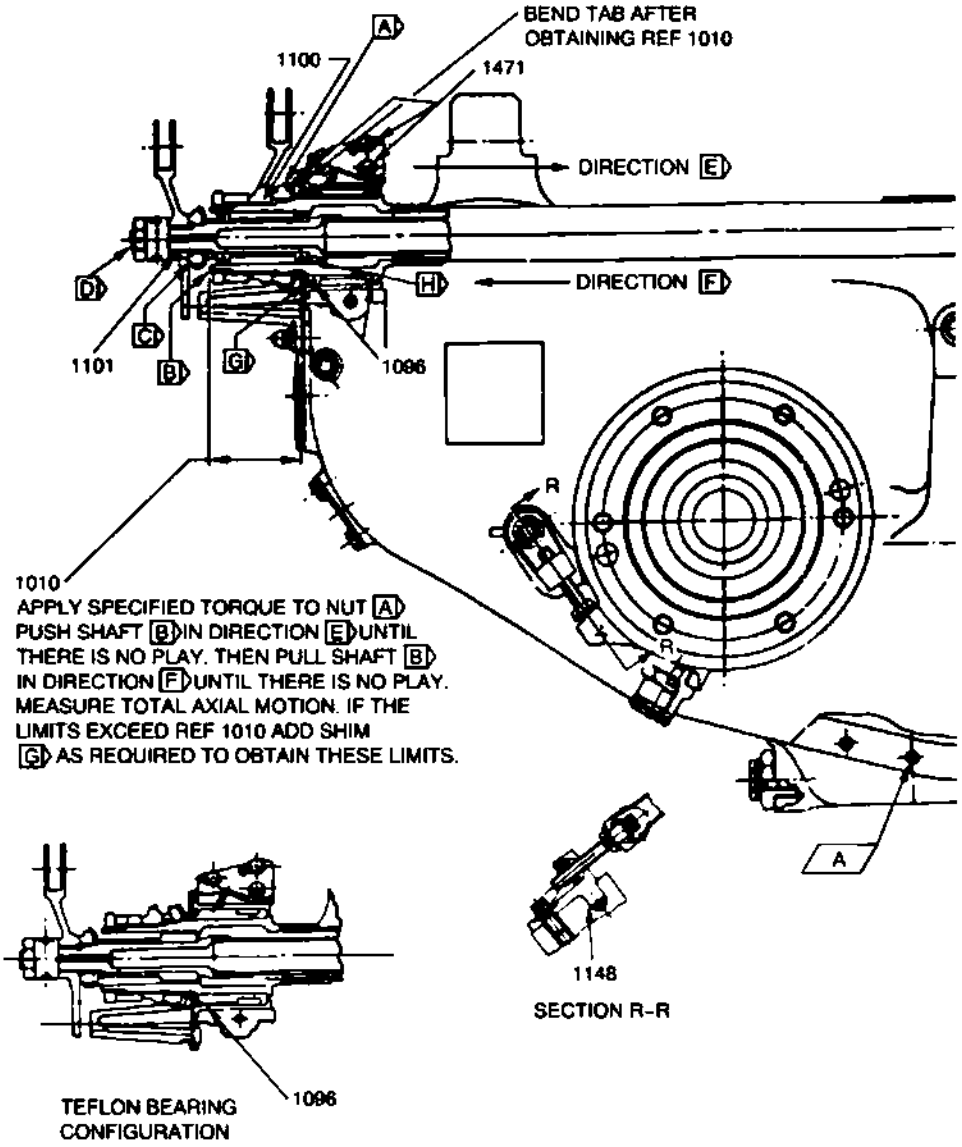
REF. NO.	DESCRIPTION	REF. DIMENSIONS MIN	REF. DIMENSIONS MAX	LIMITS MIN	LIMITS MAX	REPLACE IF OVER
1411	Strainer Element Screen, Assy of Hsg Assy Gearbox Rear			.005	.019	.022
1413	Bushing	.564	.565			
	Gearbox Housing	.561	.562	.002T	.004T	.002T
1429	The carbon seal ring must have free movement without detectable binding throughout its full travel in the seal carrier after immersion of the assy in engine oil just prior to installation in gearbox assy.					
1431	Bend Cup at Assy. Edge of Lip Must Contact Company Name Plate Securely All Around.					

B. Special Torque and Spring Loads

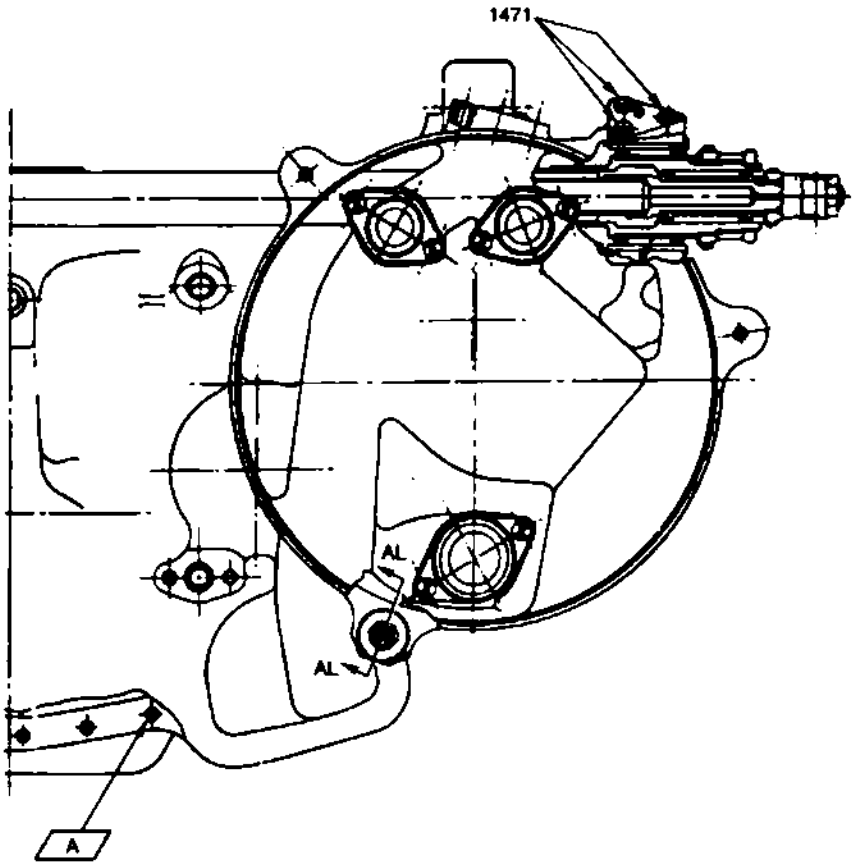
REF. NO.	DESCRIPTION	LIMITS MIN	LIMITS MAX	REPLACE
1451	Acc. Drive Gearshaft Front Retaining Nut	1500	1600	
1452	Acc. Drive Bevel Gear Roller Bearing Retaining Nut	1200	1300	
	Acc. Drive Bevel Gear Ball Bearing Retaining Nut	1500	1600	

ACCESSORY AND COMPONENT DRIVES GEARBOX
ASSEMBLY - INSPECTION/CHECK-00

REF. NO.	DESCRIPTION	LIMITS MIN	MAX	REPLACE
1454	Starter Drive Gearshaft-Retaining Nut	1300	1400	
1455	Gearbox Driveshaft Adapter-Retaining Nut	600	650	
1461	Oil Pressure Relief Valve Housing	550	650	
1471	Gearbox Cover, Compensating Rod Mounting Pad - Bolt	20	40	
1472	Oil Strainer Cover Retaining Nuts:			
	PN 640232 and Prior PNs (Locknuts)	80	100	
	PN 670862 and Prior PNs (Sleeve nuts)	25	30	
1533	Oil Screen and Spacer Support Spring - At .780 In.	31.125	35.125	29.125

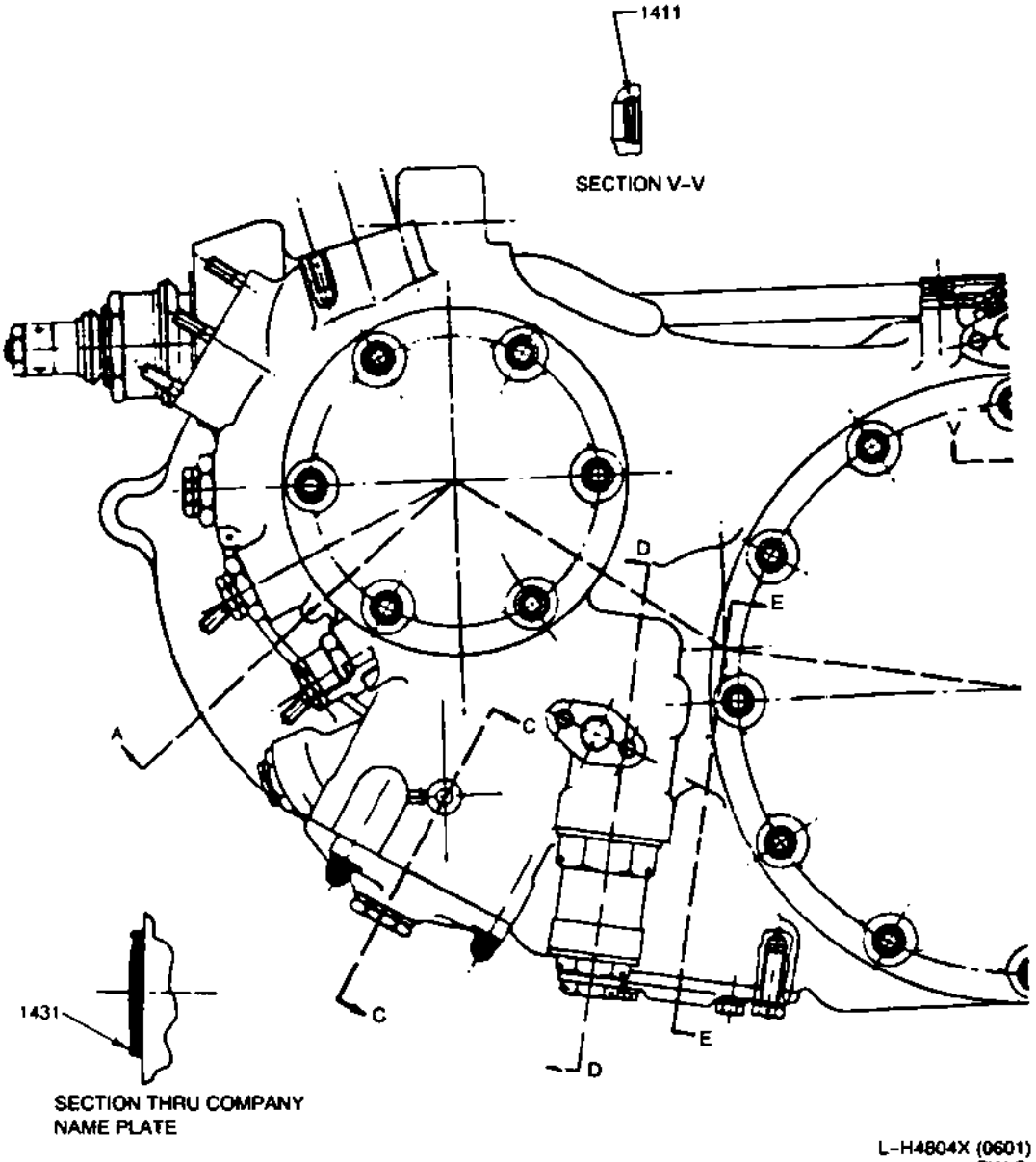


L-H4803X (0601)
PW C



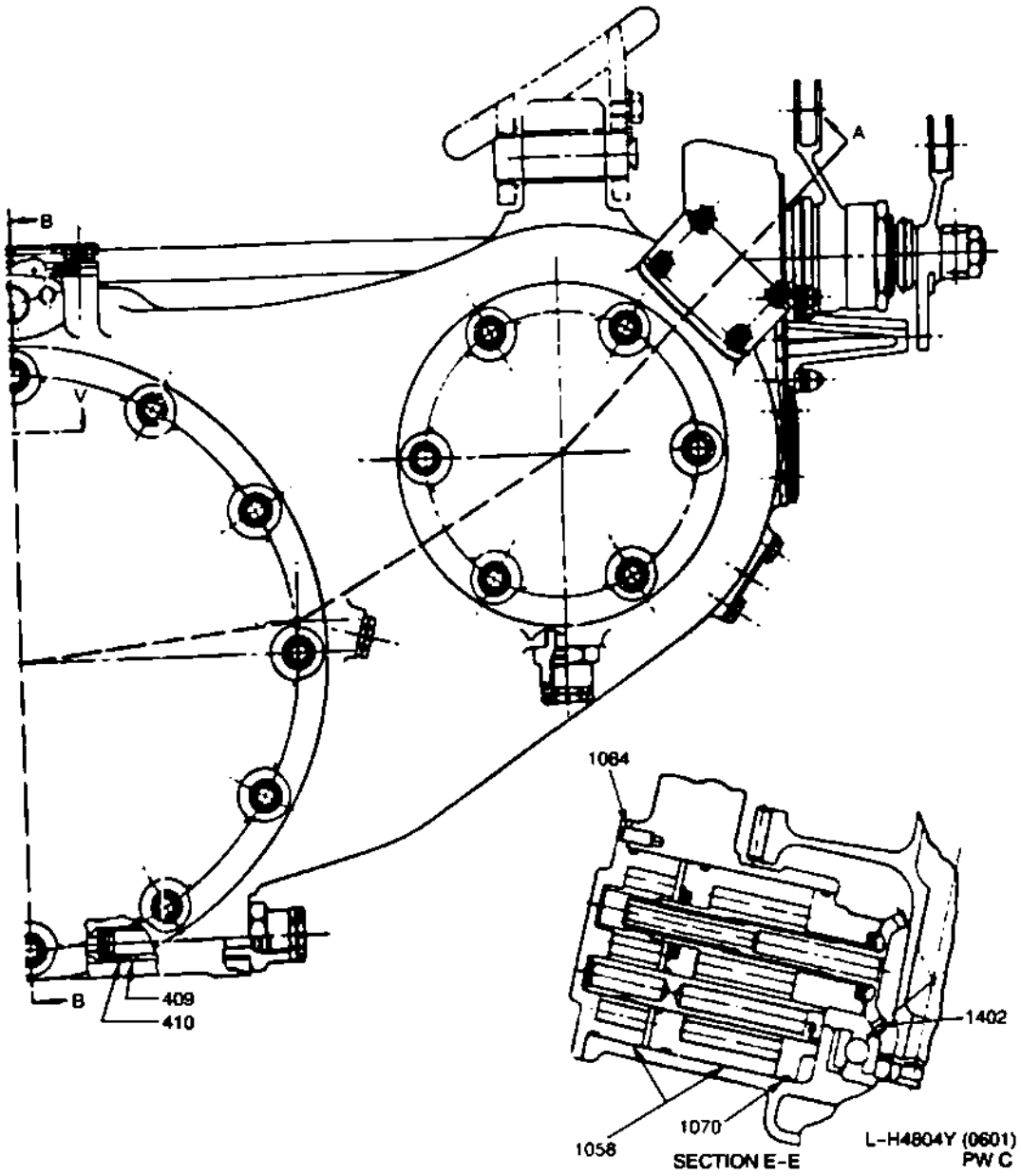
L-H4803Y (0601)
PW C

Accessory and Component
Drives Gearbox (2-6100A-69)
Figure 601 (Sheet 2)
(Task 72-61-00-990-002)

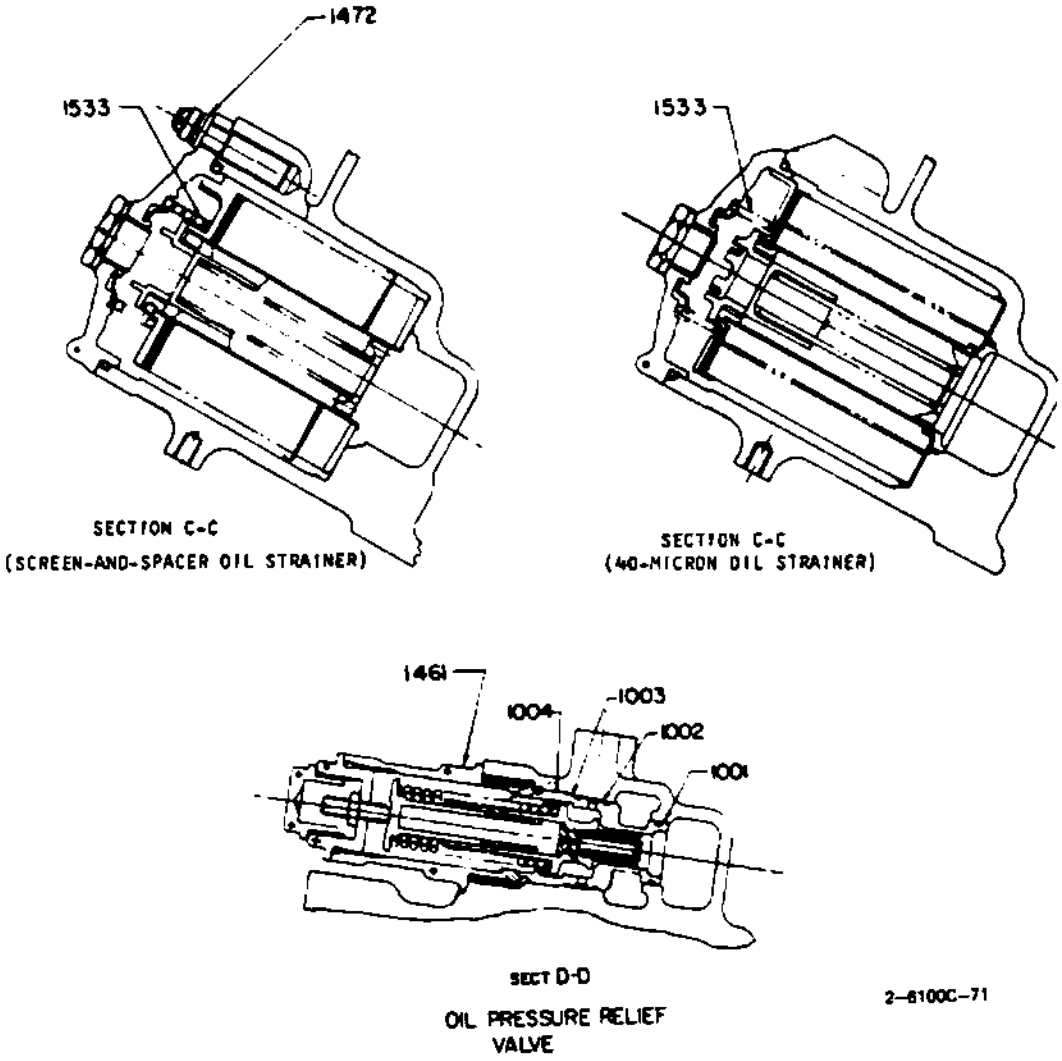


L-H4804X (0601)
PW C

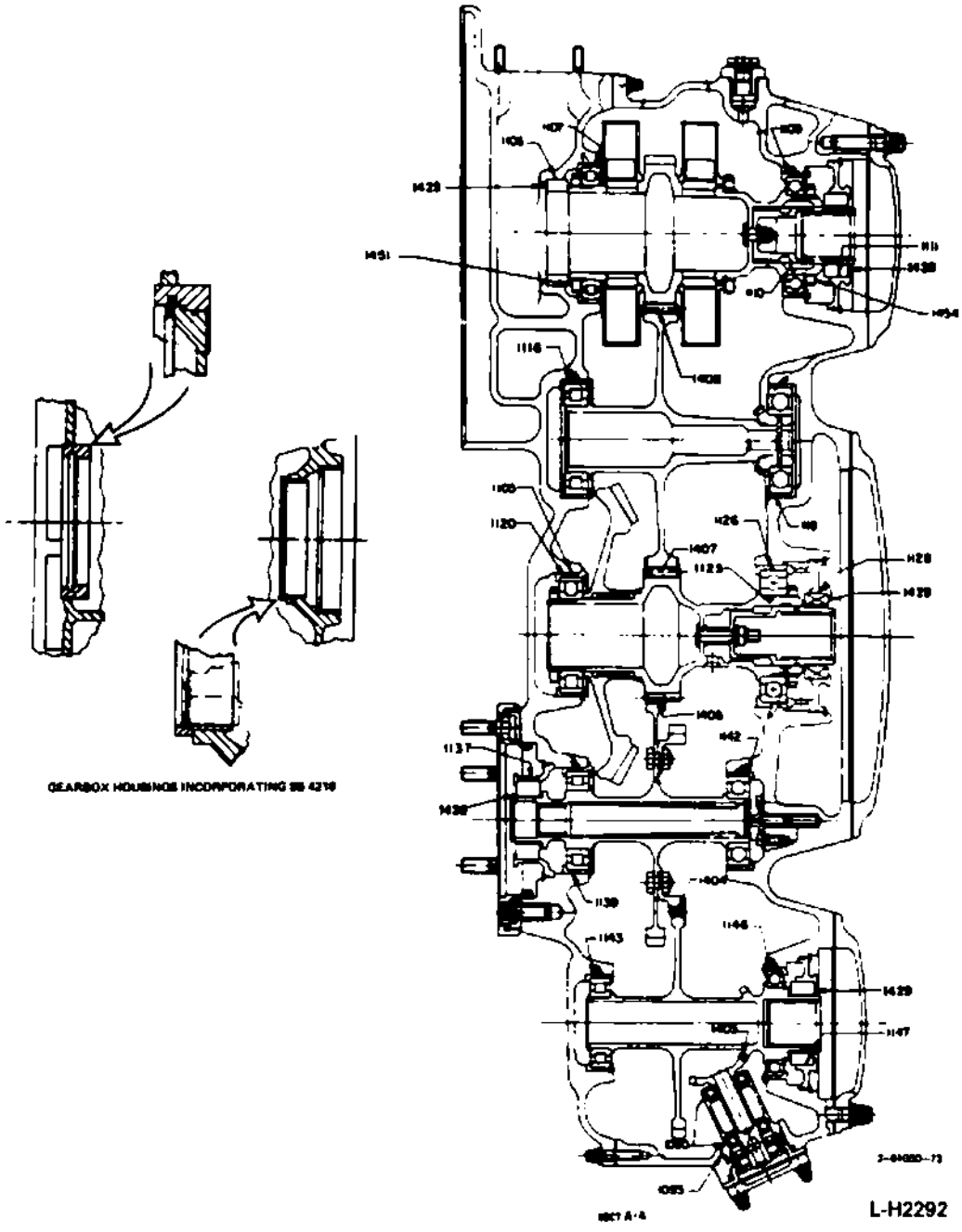
Accessory and Component
Drives Gearbox (2-6100B-69)
Figure 601 (Sheet 3)
(Task 72-61-00-990-002)



Accessory and Component
Drives Gearbox (2-6100B-69)
Figure 601 (Sheet 4)
(Task 72-61-00-990-002)

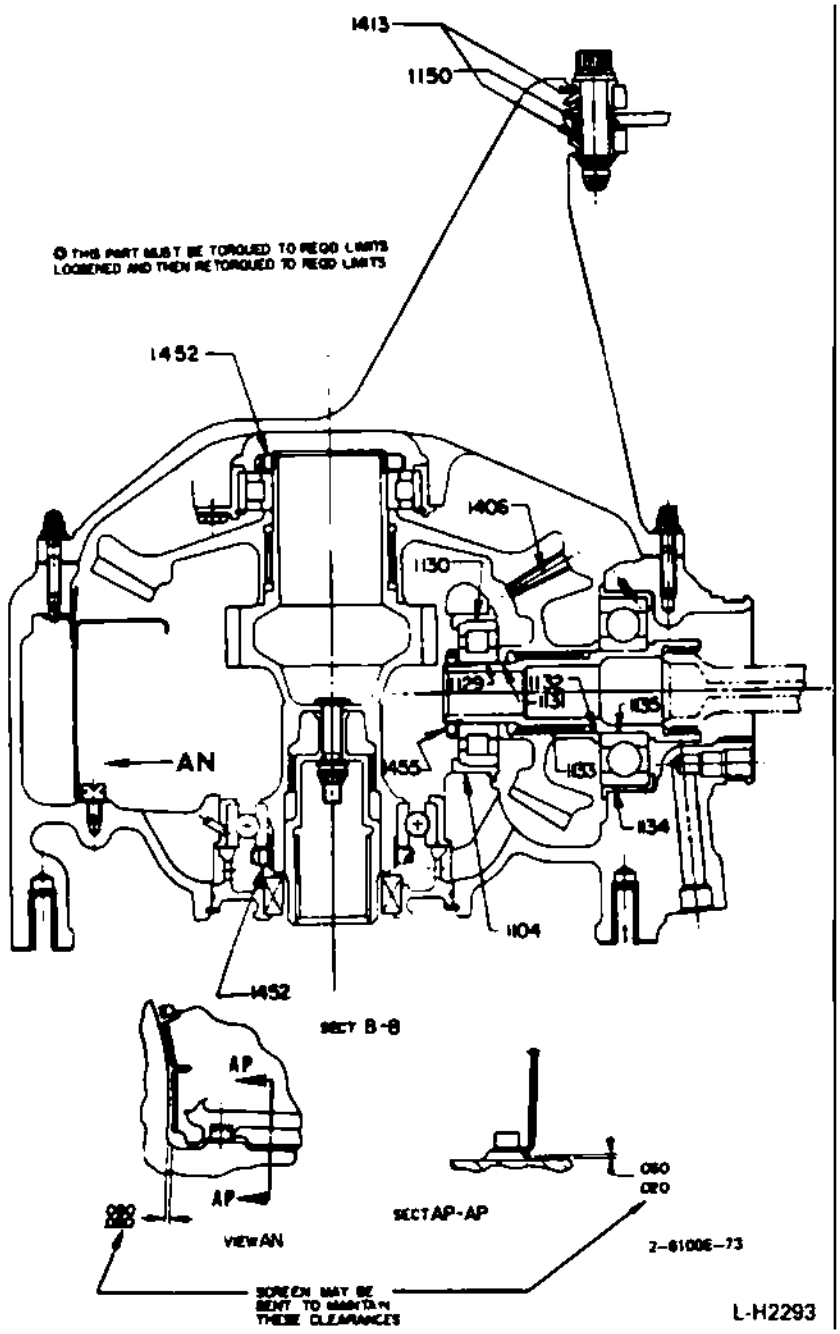


Accessory and Component
Drives Gearbox (2-6100C-71)
Figure 601 (Sheet 5)
(Task 72-61-00-990-002)



Accessory and Component
Drives Gearbox (2-6100D-736)
Figure 601 (Sheet 6)
(Task 72-61-00-990-002)

ACCESSORY AND COMPONENT DRIVES GEARBOX
ASSEMBLY - INSPECTION/CHECK-00



Accessory and Component
Drives Gearbox (2-6100E-73)
Figure 601 (Sheet 7)
(Task 72-61-00-990-002)

EFF: -ALL

STARTER DRIVE GEARSHAFT - INSPECTION/CHECK-00

Task 72-61-10-990-001:

1. Starter Drive Gearshaft

See Figure 601.

A. Fits and Clearances (For General Information, See 72-00, Engine - Removal/Installation)

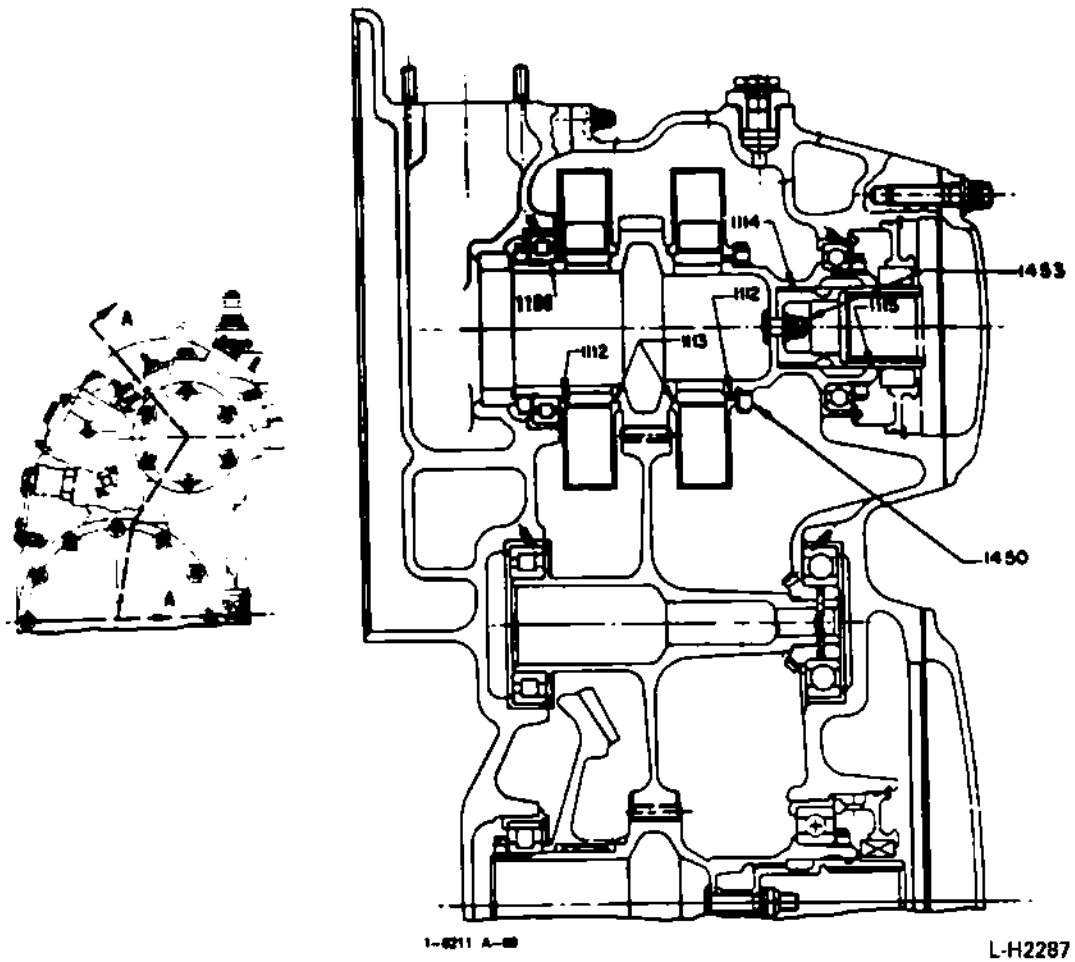
REF. NO.	DESCRIPTION	REF. DIMENSIONS MIN	REF. DIMENSIONS MAX	LIMITS MIN	LIMITS MAX	REPLACE IF OVER
1108	Starter Drive Spur Gearshaft	2.5596	2.5601			
	Bearing	2.5588	2.5591	.0005T	.0013T	*
1112	Starter Drive Spur Gearshaft (Spline)	.0740	.0750			
	Impeller Rotary Breather (Front and Rear)	.0785	.0795	.0035	.0055	.0075
1113	Starter Drive Spur Gearshaft	2.7995	2.8005			
	Impeller Rotary Breather (Front and Rear)	2.8005	2.8015	.000	.002	.003
1114	Starter Drive Gearshaft Adapter Splines	.0780	.0790			
	Spur Gearshaft (Spline)	.0785	.0795	.0005T	.0015	.0025
1115	Starter Drive Gearshaft Adapter Spline	1.5295	1.5305			
	Spur Gearshaft	1.5335	1.5350	.003	.0055	.006

B. Special Torque Limits

REF NO.	DESCRIPTION	LIMITS MIN	LIMITS MAX	REPLACE IF OVER
1450	Acc. Drive Gearshaft Rear Retaining Nut	1500	1600	

STARTER DRIVE GEARSHAFT - INSPECTION/CHECK-00

REF NO.	DESCRIPTION	LIMITS MIN	LIMITS MAX	REPLACE IF OVER
1453	Starter Drive Gear Shaft Adapter Retaining Nut	200	220	



Starter Drive
Gearshaft (1-6211A-69)
Figure 601
(Task 72-61-10-990-001)

ACCESSORY AND COMPONENT DRIVES SPUR GEARSHAFT - INSPECTION/CHECK-00

Task 72-61-20-990-001:

1. Accessory And Component Drives Spur Gearshaft

See Figure 601.

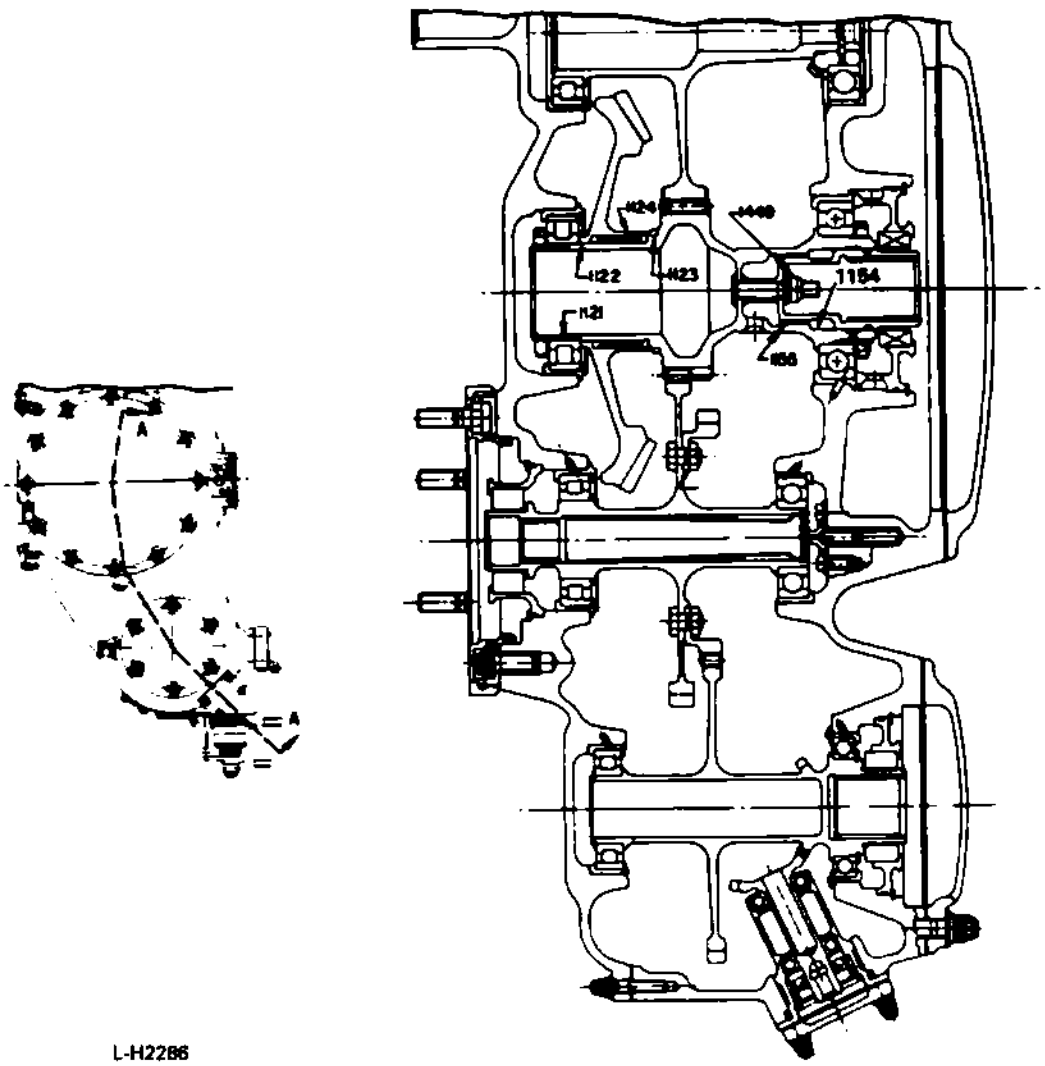
A. Fits and Clearances (For General Information, See 72-00, Engine - Removal/Installation)

REF. NO.	DESCRIPTION	REF. DIMENSIONS MIN	REF. DIMENSIONS MAX	LIMITS MIN	LIMITS MAX	REPLACE IF OVER
1121	Acc. Drive Gearbox Gearshaft	1.9689	1.9693			
	Bearing	1.9683	1.9685	.0004T	.0010T	*
1122	Acc. Drive Gearbox Gearshaft	1.974	1.975			
	Gear Bevel	1.9725	1.9735	.0005T	.0025T	.0002T
1123	Acc. Drive Gearbox Gearshaft	2.2875	2.2885			
	Gear Bevel	2.286	2.287	.0005T	.0025T	.0002T
1124	Acc. Drive Gearbox Gearshaft	.0956	.0966			
	Gear Bevel (Spline)	.0981	.0991	.0015	.0035	.0055
1154	Acc. Drive Gearshaft Coupling	1.5985	1.5991			
	Acc. Drive Gearshaft	1.5991	1.6000	.000	.0015	.002
1155	Acc. Drive Gearshaft Coupling (Spline)	.0740	.0750			
	Acc. Drive Gearshaft Spline	.0785	.0795	.0035	.0055	.0075

B. Special Torque Limits

ACCESSORY AND COMPONENT DRIVES SPUR GEARSHAFT - INSPECTION/CHECK-00

REF NO.	DESCRIPTION	LIMITS MIN	LIMITS MAX	REPLACE IF OVER
1449	Gearbox Acc. Drive Gearshaft Coupling Retaining Nut	200	220	



Accessory and Component Drives
Spur Gearshaft (1-6209A-69)
Figure 601
(Task 72-61-20-990-001)

TACHOMETER DRIVE (N2) GEARSHAFT - INSPECTION/CHECK-00

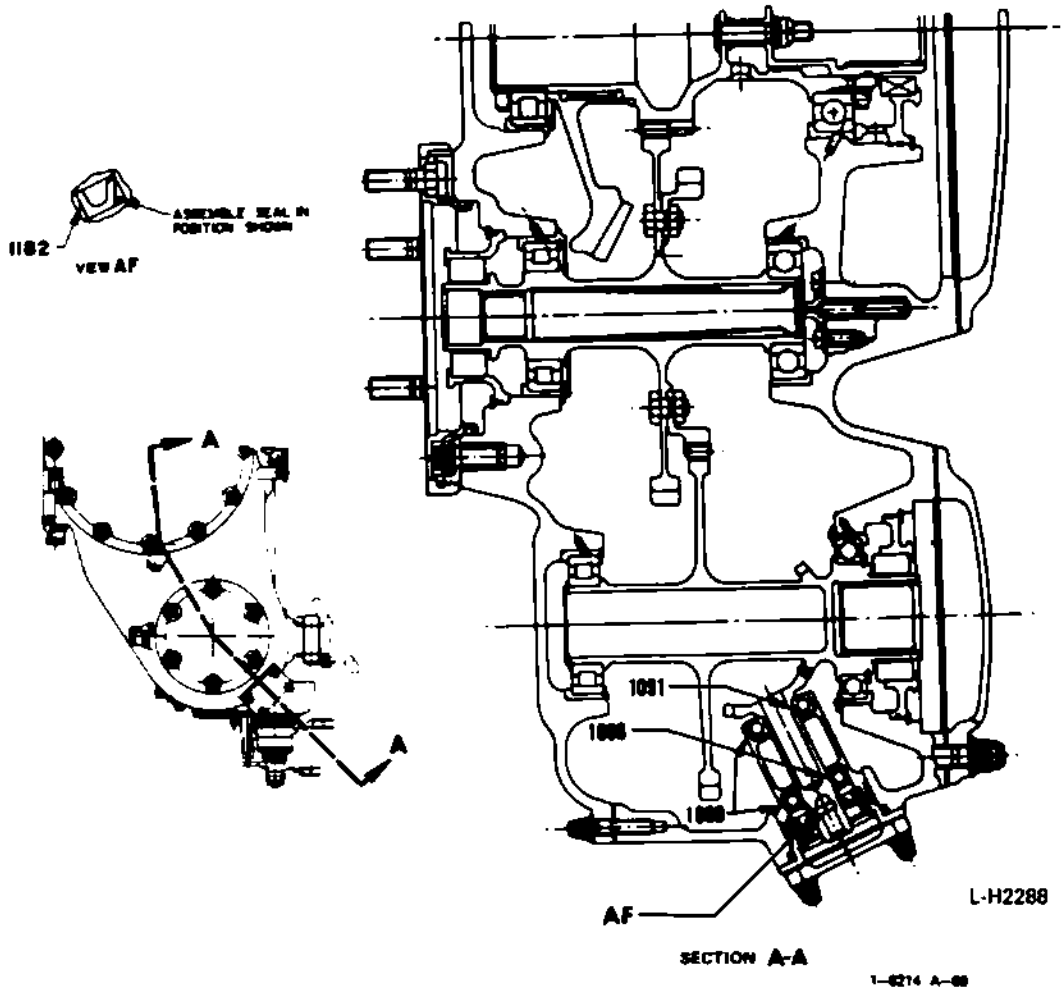
Task 72-61-40-990-001:

1. Tachometer Drive (N2) Gearshaft

See Figure 601.

A. Fits and Clearances (For General Information, See 72-00, Engine - Removal/Installation)

REF. NO.	DESCRIPTION	REF. DIMENSIONS MIN	REF. DIMENSIONS MAX	LIMITS MIN	LIMITS MAX	REPLACE IF OVER
1086	Tachometer Drive Bevel Gearshaft	.5896	.5901			
	Bearing ID	.5903	.5906	.0002	.001	.001
1090	Bearing (OD) Tachometer Drivegear Shaft Bearing	1.2593	1.2598			
	Housing	1.2598	1.2605	.0000	.0012	.0014
1091	Tachometer Drive Bevel Gearshaft	.5905	.5908			
	Bearing ID	.5903	.5906	.0001	.0005T	.0001
1182	Tachometer Drive Oil Seal Housing	1.253	1.260	.002T	.011T	
		1.249	1.251			



Tachometer Drive (N2)
Gearshaft (1-6214A-69)
Figure 601
(Task 72-61-40-990-001)

MAIN OIL PUMP ASSEMBLY - INSPECTION/CHECK-00

Task 72-61-50-990-001:

1. Main Oil Pump Assembly

See Figure 601.

A. Fits and Clearances (For General Information, See 72-00-00, ENGINE - REMOVAL/INSTALLATION)

REF. NO.	DESCRIPTION	REF. DIMENSIONS MIN	REF. DIMENSIONS MAX	LIMITS MIN	LIMITS MAX	REPLACE IF OVER
1059	Oil Pump Dowel					
	Bolt - Oil Pump Cover - Spacer - Body &	.2485	.2495			
	Rear Cover	.2495	.2505	.000	.002	
1060	Oil Pump Dowel					
	Bolt	.2485	.2495			
	Spacer	.2495	.2505	.000	.002	
1071	Idler Oil Pump					
	Shaft	.6015	.6020			
	Oil Pump Spacers Outer Cover and					
	Pump Housing	.603	.604	.001	.0025	.0035
1072	Idler Oil Pump					
	Shaft	.6038	.6043			
	Inner Cover	.6018	.6028	.001T	.0025T	*
1073	Oil Pump Idler					
	Shaft	.6015	.6020			
	Idler Gears	.6030	.6040	.001	.0025	.0035
1074	Oil Pump					
	Gearshaft	.6855	.6860			
	Oil Pump Spacer and					
	Pump Housing	.687	.688	.0010	.0025	.003
1075	Oil Pump					
	Gearshaft	.6855	.6860			
	Drivegear	.687	.688	.001	.0025	.003

MAIN OIL PUMP ASSEMBLY - INSPECTION/CHECK-00

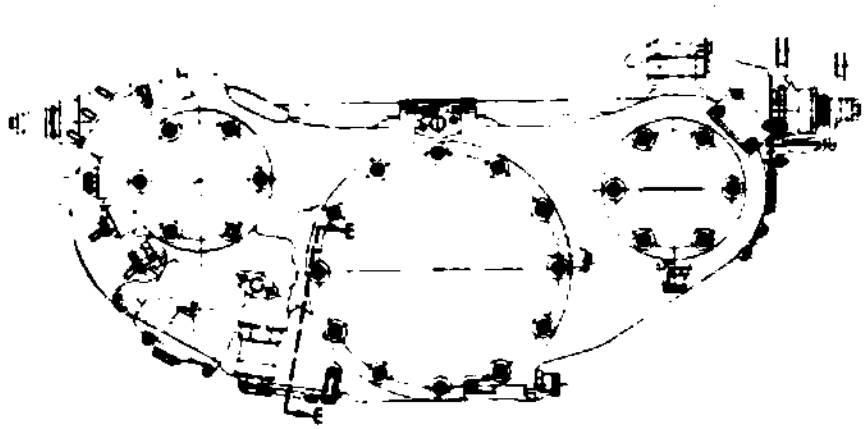
REF. NO.	DESCRIPTION	REF. DIMENSIONS MIN	REF. DIMENSIONS MAX	LIMITS MIN	LIMITS MAX	REPLACE IF OVER
1076	Oil Pump Bevel Gearshaft (Spline)	.0465	.0475			
	Drivegears (Spline)	.0490	.0505	.0015	.0040	.006
1077	Oil Pump Gear	.7170	.7175			
	Outer Cover	.7185	.7195	.001	.0025	.0035
1078	Oil Pump Gears (End clearance)	.8695	.8700			
	Outer Cover	.8715	.8735	.0015	.0040	.0040
1079	Oil Pump Gears	1.499	1.501			
	Outer Cover and Pump Housing	1.504	1.506	.003	.007	.008
1080	Plain Encased Seal (PN 494956)	1.126	1.130			
	Oil Pump Inner Cover and Pump Body (Pump Assy (PN 515107)	1.123	1.125	.001T	.007T	.001T
	Plain Encased Seal (PN 433211)	1.064	1.068			
	Oil Pump Inner Cover and Pump Body (Pump Assy PNs 493987 and 493997)	1.061	1.063	.001T	.007T	.001T
1081	(JT8D-1,-1A,-1B) Bevel Gearshaft -					
	Oil Pump Inner Cover	.6855 .6870	.6860 .6880	.0010	.0025	.003
1082	Oil Pump Gears (End clearance)	1.6993	1.7000			
	Housing	1.7015	1.7035	.0015	.0042	.0042

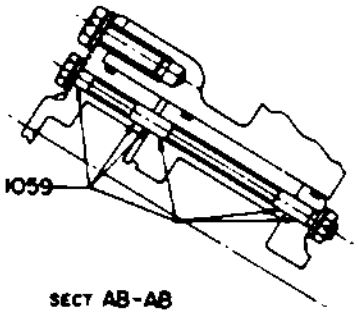
MAIN OIL PUMP ASSEMBLY - INSPECTION/CHECK-00

REF. NO.	DESCRIPTION	REF. DIMENSIONS MIN	REF. DIMENSIONS MAX	LIMITS MIN	LIMITS MAX	REPLACE IF OVER
1085	(JT8D-1,-1A,-1B)					
	Dowel Pin	.0620	.0630			
	Oil Pump Housing and Cover	.0600	.0620	.000	.003T	.000
1087	Oil Pump Gearshaft	.6855	.6860			
	Inner Cover	.687	.688	.001	.0025	.0025
1095	Bevel Gearshaft	.5775	.5780			
	Gear Spur Drive	.5790	.5800	.001	.0025	
1401	Oil Pump Gears Spur Idler Gear Spur (Backlash)			.0045	.0195	

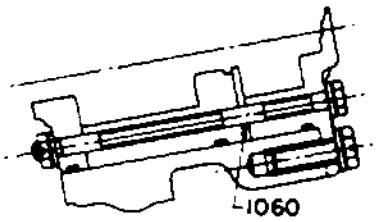
B. Special Torque Limits

REF NO.	DESCRIPTION	LIMITS MIN	LIMITS MAX	REPLACE IF OVER
1473	Inner Oil Pump Cover Retaining Nut	65	85	

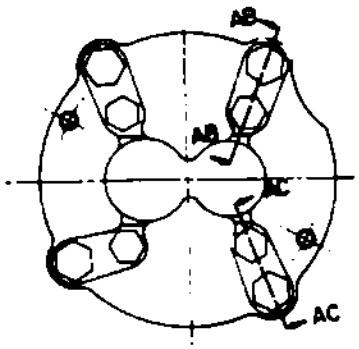




SECT AB-AB



SECT AC-AC

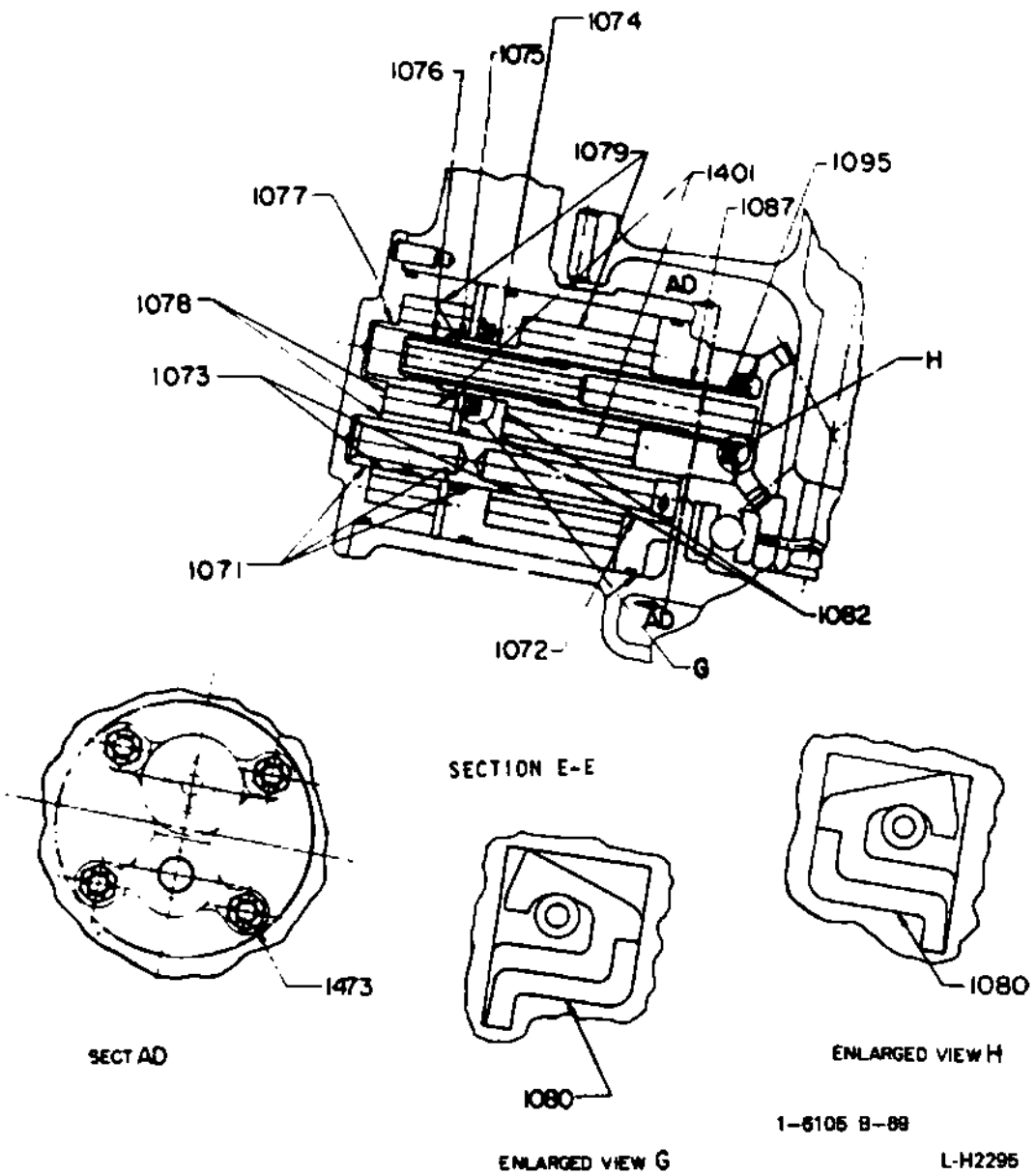


1-6105 A-69

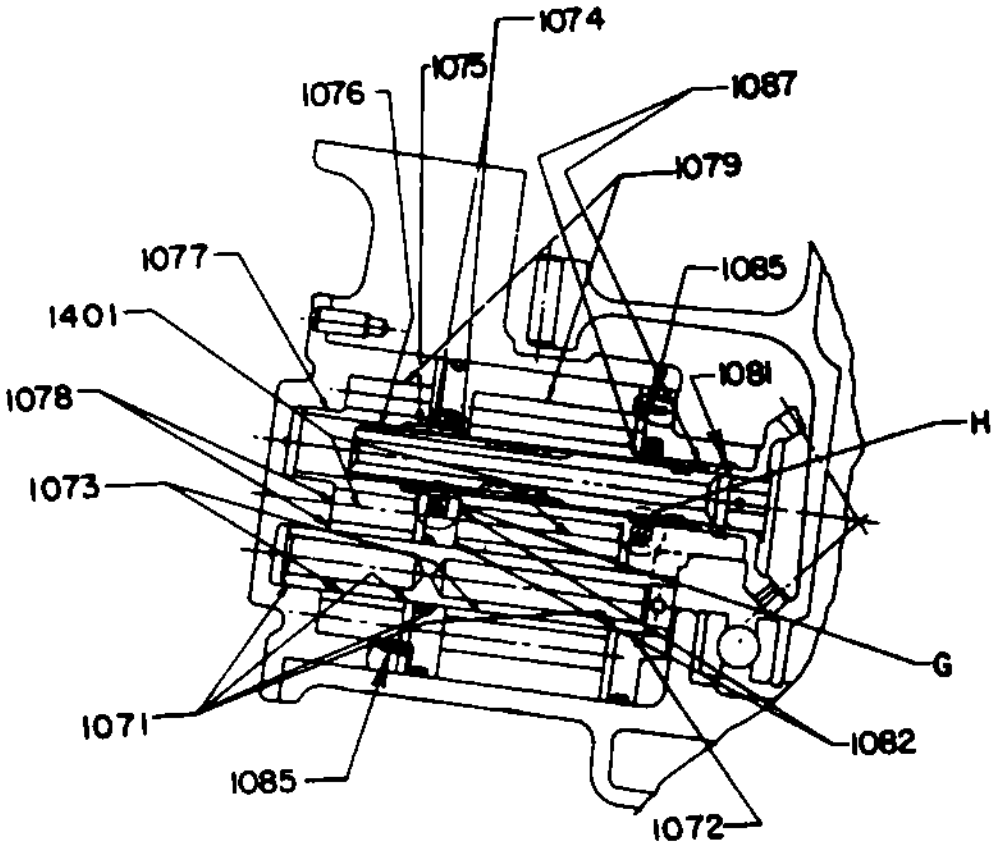
(OIL PUMP COVER)

L-H2294

Main Oil Pump
Assembly (1-6105A-69)
Figure 601 (Sheet 1)
(Task 72-61-50-990-001)



Main Oil Pump
Assembly (1-6105B-69)
Figure 601 (Sheet 2)
(Task 72-61-50-990-001)



E-E

1-6105 C-69

MAIN OIL PUMP FOR EARLY ENGINES

L-H2296

Main Oil Pump Assembly
(12345 6105C-83)
Figure 601 (Sheet 3)
(Task 72-61-50-990-001)

OIL PRESSURE RELIEF VALVE - MAINTENANCE PRACTICES-00

Task 72-61-51-300-001:

1. Oil Pressure Relief Valve Repair

   A. Remove Oil Pressure Relief Valve. See Section 72-61-00.

   B. Oil Pressure Relief Valve - Strainer Replacement
      See Figures 201 and 202.

      (1) Remove pin and strainer from housing.

      (2) Install new strainer into housing.

      (3) Drill .060 to .062 inch diameter pinhole using existing hole in housing as guide.

      (4) Install and stake pin as shown.

   C. Disassembly

      (1) Remove hexhead plug, packing, and housing plug (with adjusting screw and locknut) from oil pressure relief valve housing.

      (2) Remove helical retainer, spring, and valve assembly from oil pressure relief valve housing.

   D. Cleaning

      (1) If abnormally low oil pressure has occurred during engine operation, inspect component parts for obvious defects.

      (2) Polish sliding surfaces of valve assembly and spring retainer with No. 400 Crocus Cloth soaked in oil.

      (3) After polishing, clean thoroughly with petroleum solvent and check operation after installation.

   E. Assembly

      (1) Install valve assembly into housing, small end inboard.

      (2) Position valve spring over OD of valve assembly.

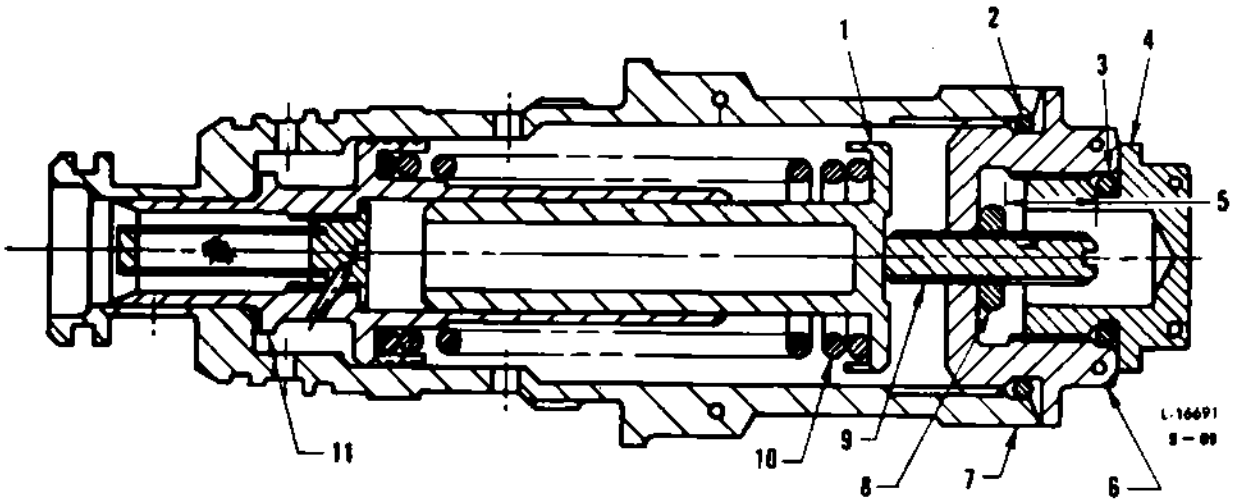
      (3) Install helical retainer into ID of valve assembly and over valve spring.

(4) Position preformed packing next to flange on housing plug OD; then thread plug into valve housing. Tighten plug and lockwire to valve housing.

(5) Thread adjusting screw into housing plug with screw slot to outside of housing. Install jamnut on screw and adjust screw to initial setting as shown in Figure 201, and tighten jamnut.

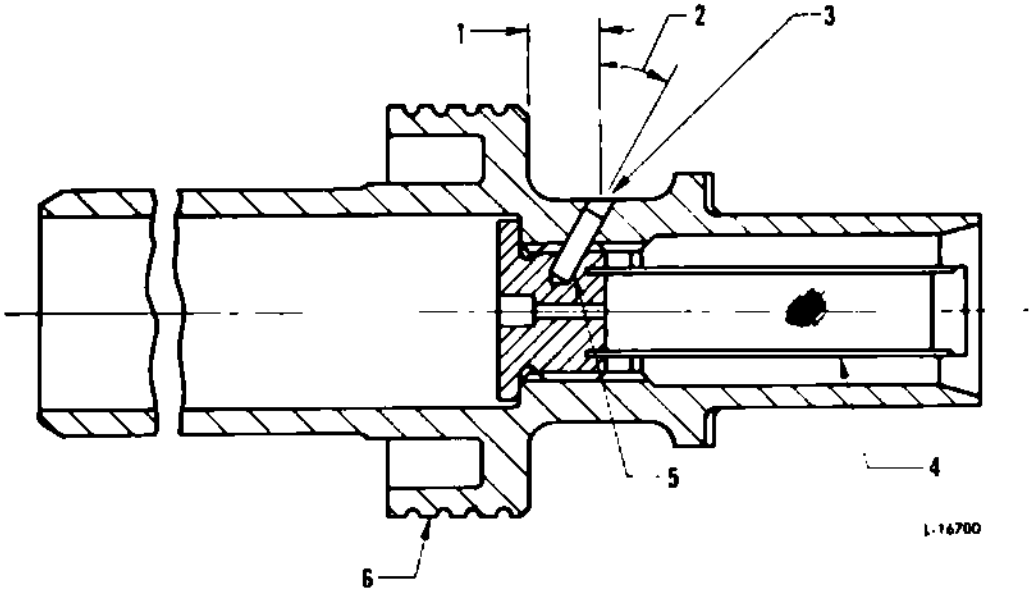
(6) Install preformed packing next to flange on hexhead cover plug (Index No. 4 in Figure 201). Thread cover plug into housing Inspection/Check-00 plug (Index No. 5 in Figure 201) and plug to Fits and Clearances Reference Number 1476. Lockwire cover plug to housing plug.

(7) Install oil pressure relief valve into gearbox assembly. See Section 72-61-00, Removal/Installation-00.



1. Helical Spring Retainer
2. Packing
3. Packing
4. Plug
5. 0.375 To 0.475 Inch (Initial Setting)
6. Plug
7. Housing
8. Nut
9. Adjusting Screw
10. Spring
11. Oil Pressure Relief Valve Assembly

Oil Pressure Relief Valve Assembly
Figure 201
(Task 72-61-51-300-001)



1. 0.210 Inch
2. 30 Degrees ± 2
3. 0.060 To 0.062 Inch Diameter To 0.240 To 0.260 Inch Depth Located Within 0.030 Inch Of True Position
4. Strainer
5. Pin. Stake Two Places Approximately 180 Degrees Apart
6. Oil Pressure Relief Valve

Oil Pressure Relief Valve
Strainer Replacement
Figure 202
(Task 72-61-51-300-001)

OIL PRESSURE RELIEF VALVE - INSPECTION/CHECK-00

Task 72-61-51-990-001:

1. Oil Pressure Relief Valve

See Figure 601.

A. Fits and Clearances (For General Information, See 72-00-00, ENGINE - REMOVAL/INSTALLATION)

REF. NO.	DESCRIPTION	REF. DIMENSIONS MIN	REF. DIMENSIONS MAX	LIMITS MIN	LIMITS MAX	REPLACE IF OVER
1005	Oil Pressure Relief Valve	.5287	.5292			
	Oil Pressure Relief Valve Housing	.5307	.5317	.0015	.003	
1006	Oil Pressure Relief Valve	1.1245	1.1250			
	Oil Pressure Relief Valve Housing	1.1260	1.1270	.001	.0025	
1009	Helical Compr Spring Retainer	.5292	.5297			
	Oil Pressure Relief Valve	.5302	.5312	.0005	.002	
1427	Pressure Relief Valve	.5272	.5277			
	Housing	.5307	.5317	.003	.0045	.0045

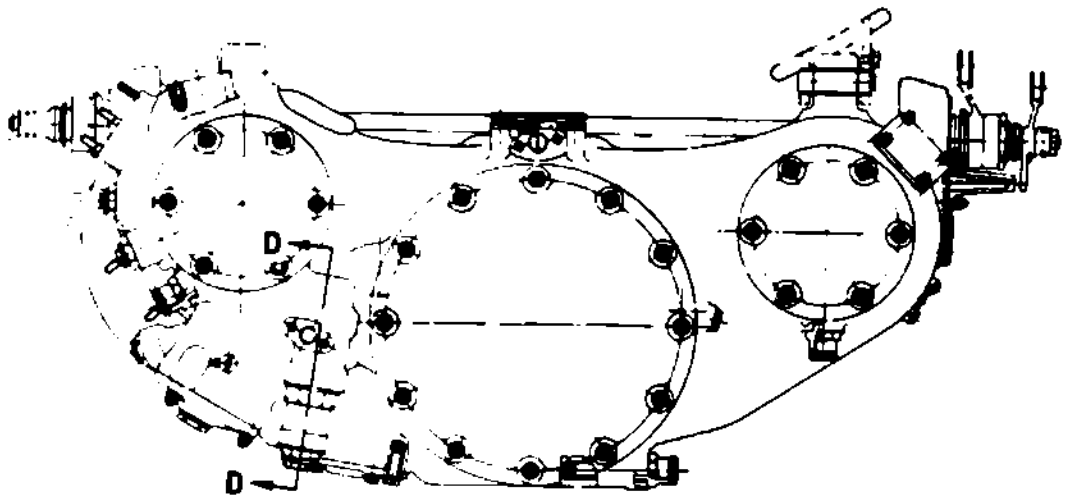
B. Special Torque Limits

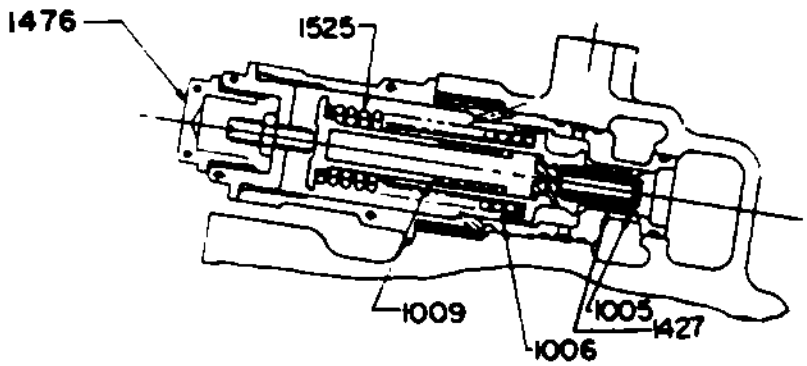
REF NO.	DESCRIPTION	LIMITS MIN	LIMITS MAX	REPLACE IF OVER
1476	Oil Pressure Relief Valve Adjusting Screw Cover Plug	150	160	

C. Spring Loads

OIL PRESSURE RELIEF VALVE - INSPECTION/CHECK-00

REF NO.	DESCRIPTION	LIMITS MIN	LIMITS MAX	REPLACE IF OVER
1525	Oil Pressure Relief Valve Spring At 2.405 Inches	31.500	33.000	





SECT D-D

1-6106 A-69

OIL PRESSURE RELIEF VALVE

L-H2297

Oil Pressure Relief
Valve (1-6106A-69)
Figure 601
(Task 72-61-51-990-001)

Task 72-61-53-430-001:

R 1. Disassembly/Assembly of the Main Oil Filter/Strainer

R A. Remove the main oil filter/strainer. See Section 72-61-00,
R Removal/Installation-00.

R B. Disassembly (175-Micron Strainer)

(1) Position main oil strainer assembly in PWA 14406 Fixture. Remove retaining nut with the PWA 10014 Wrench. (Use PWA 10347 Fixture for engines not incorporating SB 992.)

(2) Lift out bypass valve and valve spring.

(3) Slide support, screens, spacers, and end plate from baffle and onto rod. Ensure that rod is provided with stops to prevent screens and spacers from sliding off during cleaning operations.

R (4) Examine the strainer parts for foreign material.

R NOTE: For more information about main oil strainer
R inspection and for guidance with corrective
R action, refer to the JT8D Oil Monitoring Guide,
R PN 821432.

R C. Assembly (175-Micron Strainer)
See Figure 201 (Sheet 1 and 2)

(1) Replace damaged screens or spacer.

NOTE: When replacing spacers, make certain that an oil inlet or oil outlet spacer is replaced by a like part.

(2) Install baffle and end plate on PWA 14406 Fixture. (Use PWA 10347 Fixture for engines not incorporating SB 992.) Install screens and spacers stack up on baffles as shown in figure with following exceptions:

(a) For earlier assemblies reworked in accordance with SB 862, identified by change letter A- SL 60744 marked after part number, install PN 523830 inlet spacer as an inlet spacer at an Index No. 12 dimension of 0.605 inch before application of torque. Index No. 13 outlet spacer not required, only 28 Index No. 2 inlet spacers required, and 30 Index No. 4 outlet spacers required.

(b) For earlier assemblies not reworked in accordance with SB 862, Index No. 13 outlet spacer not required, Index No. 12 is not applicable, and 30 Index No. 4 outlet spacers required.

(c) If desired, assemble strainer assembly in accordance with Figure 201 to bring step (a) and (b) configurations up to latest configuration. Remove and replace spacers as necessary.

(3) Install seat assembly over screens and spacers, aligning pin in seat with slot in baffle bushings. Position fixture cover over support and secure with wing nuts.

(4) Insert spring and bypass valve in baffle ID.

(5) Depress bypass valve and hand start retaining nut.

(6) Using PWA 10014 Wrench, tighten nut so that it is seated on baffle bushing and spacers and screens cannot be rotated by hand. Maintain Index 1 dimension in figure. Visually inspect seating of nut against bushing through slot of seat assembly.

D. Disassembly of 40 Micron-Type Oil Strainer
See Figure 201 (Sheet 3).

(1) Position strainer in PWA 14406 Fixture and remove retaining nut using PWA 10014 Wrench.

(2) Lift out strainer element, valve, and spring.

R (3) Examine the strainer element for foreign material.

R NOTE: For more information about main oil strainer
R inspection and for guidance with corrective
R action, refer to the JT8D Oil Monitoring Guide,
R PN 821432.

E. Assembly of 40 Micron-Type Oil Strainer

(1) Install two O-rings on bottom of strainer sleeve.

(2) Install spring, valve, and strainer element.

(3) Depress bypass valve and hand start retaining nut.

(4) Position strainer in PWA 14406 Fixture and torque retaining nut to 40 - 50 lb-in. using PWA 10014 Wrench.

R F. Disassembly of 15 Or 70 Micron-Type (Disposable) Oil Filter See Figure 201 (Sheet 4).

(1) Depress keywasher from slots in bypass valve and remove cover.

(2) Place element and bypass valve on PWA 33201 Base (bypass valve end up). Remove element from valve assembly using PWA 16477 Drift.

(3) Remove spiral retaining ring and keywasher from cover.

R (4) Examine the filter element for foreign material.

R NOTE: For more information about main oil filter
R inspection and for guidance with corrective
R action, refer to the JT8D Oil Monitoring Guide,
R PN 821432.

R G. Assembly of 15 Or 70 Micron-Type (Disposable) Oil Filter

(1) Install keywasher in groove in cover and secure with spiral retaining ring.

(2) Install pressure relief valve to above keywasher. Ensure that tabs of keywasher engage slots in pressure relief valve.

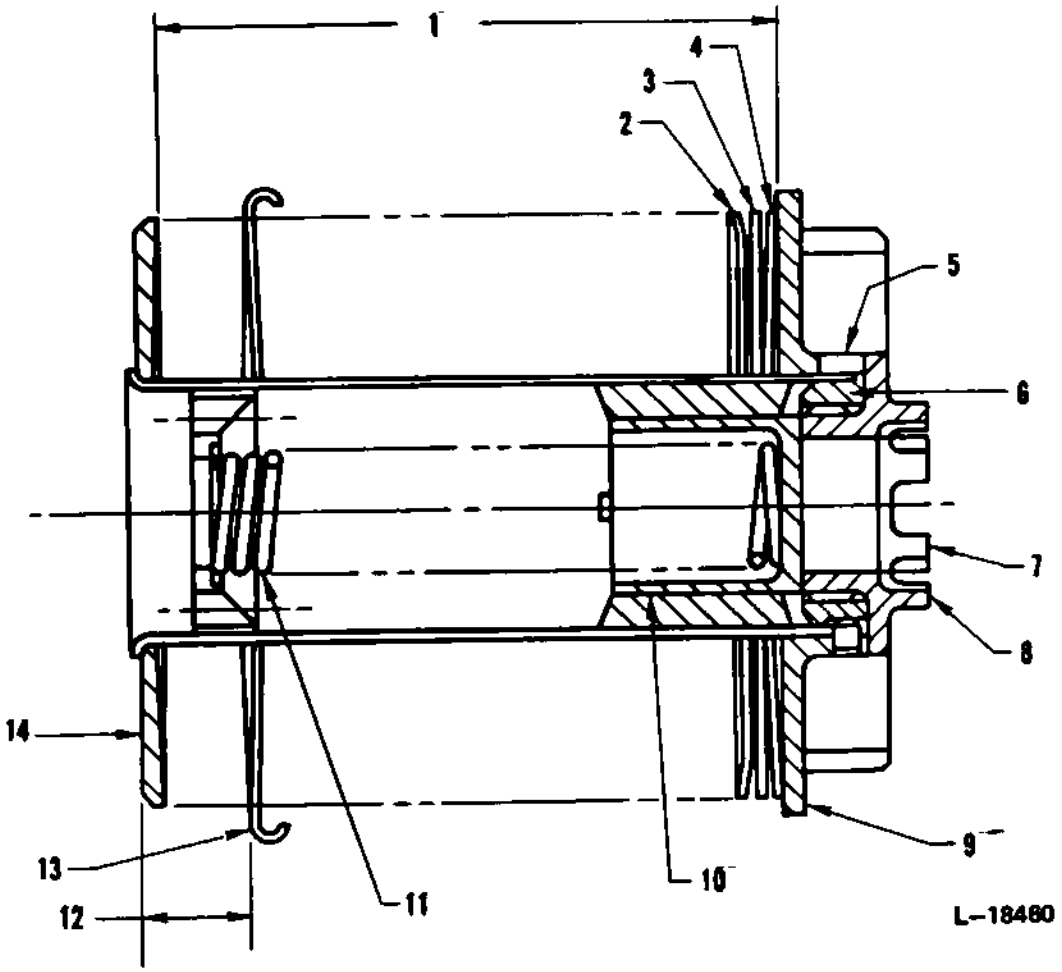
R (3) Install the filter element to the pressure relief
R valve, with the larger OD flange away from the valve.

Task 72-61-53-990-001:

2. Numerical Tool List

R A. Special Tools

PWA 10014	Wrench - Main Oil Strainer Nut
PWA 10347	Fixture - Main Oil Strainer Assembly (Superseded by PWA-14406)
PWA 14406	Fixture - Main Oil Strainer Assembly
PWA 16477	Drift - Oil Filter Bypass Valve
PWA 33201	Base - Oil Filter Bypass Removal

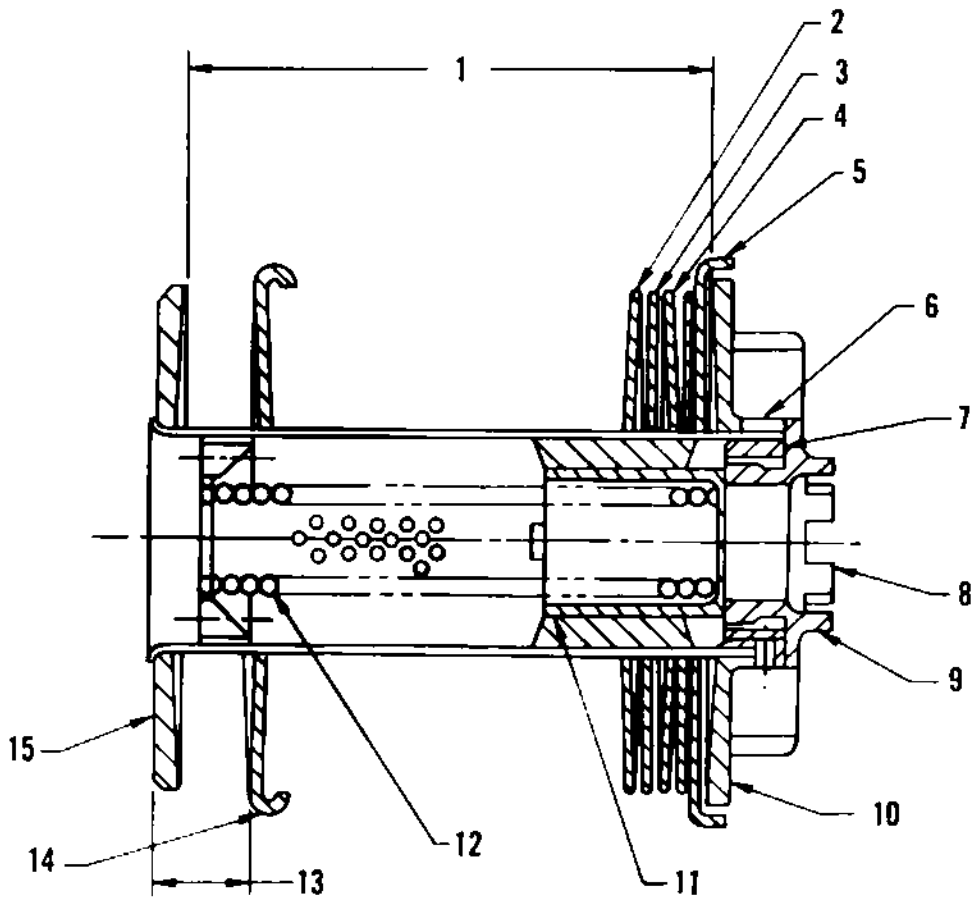


Screen and Spacer-Type
Main Oil Strainer
Figure 201 (Sheet 1)
(Task 72-61-53-990-001)

1. 3.160 Inches Reference. Listed Nominal Quantities of Inlet Spacers, Outlet Spacers, And Screens Are Required To Obtain This Dimension. This Dimension Is An Approximate Figure For Average Stacked Parts Tolerances, And Is Used For Assembly References To Determine If Any Inlet Spacer, Outlet Spacer, Or Screen May Have Been Omitted Or Extra Parts Included. Assembly Is Considered Acceptable Between 3.130 Inches And 3.190 Inches When All Other Conditions Are Met. Complete Sets Of Parts Consisting Of Two Screens And One Each Of Outlet And Inlet Spacers Must Be Added Or Removed To Obtain Desired Dimension. Oil Outlet Spacer Must Be At Each End Of Stack.
2. PN 317028 Inlet Spacer, 29 Required
3. PN 429238 Screen, 58 Required
4. PN 317029 Outlet Spacer, 29 Required
5. Slot
6. Bushing
7. Complete Sets Of Parts Consisting Of Two Screens And One Of The Inlet And Outlet Spacers Must Be Added Or Removed, If Required, So That Screens And Spacers Cannot Be Rotated By Hand When Index No. 8 Nut Is Tightened With Torque Sufficient To Seat It Solidly Against Index No. 6 Bushing As Visually Inspected Through Index No. 5 Slots.
8. Nut
9. Seat Assembly
10. Bypass Valve
11. Spring
12. 0.575 Inch Reference Before Application Of Torque.
13. PN 523550 Outlet Spacer. Install As Outlet Spacer At Index No. 12 Location.
14. Strainer Sleeve Assembly

Key to Figure 201 (Sheet 1)

R
R



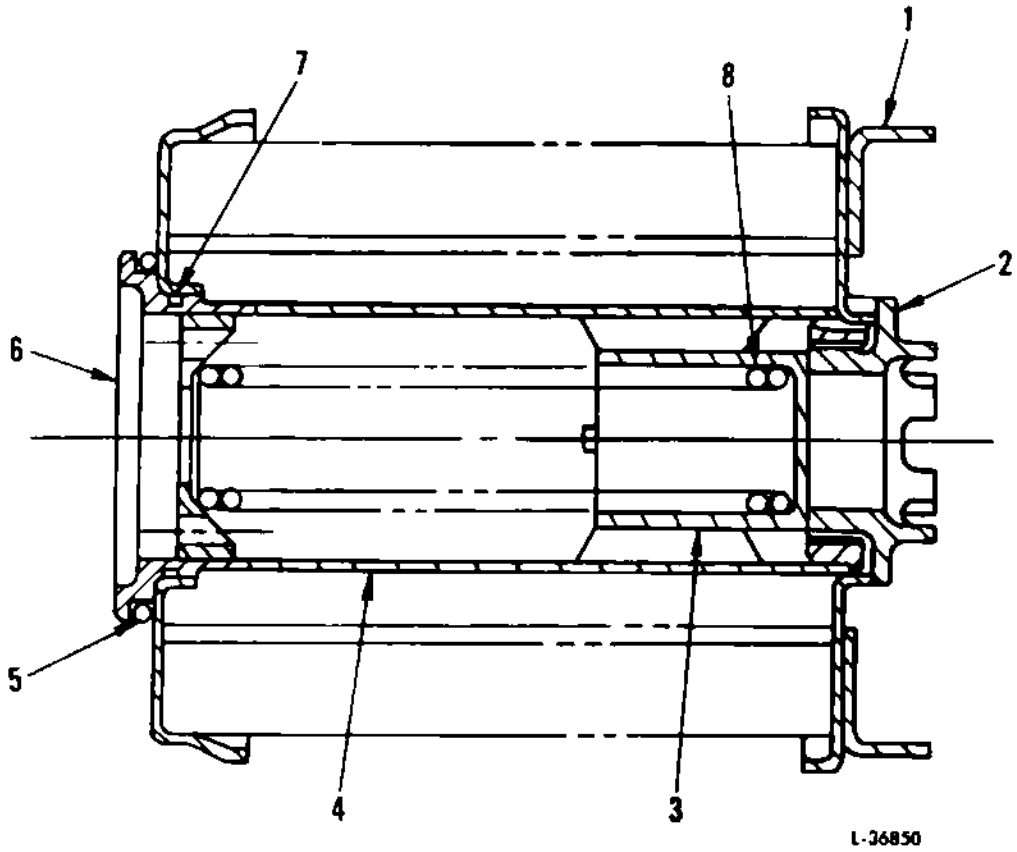
Screen and Spacer Main Oil Strainers Incorporating PN 699147 - Type Outlet Spacers
Figure 201 (Sheet 2)
(Task 72-61-53-990-001)

R
R

1. 3.160 Inches Reference. Listed Nominal Quantities of Inlet Spacers, Outlet Spacers, and Screens Are Required To Obtain This Dimension. This Dimension Is An Approximate Figure For Average Stacked Parts Tolerances, And Is Used For Assembly Reference To Determine If Any Inlet Spacer, Outlet Spacer, Or Screen May Have Been Omitted Or Extra Parts Included. Assembly Is Considered Acceptable Between 3.130 And 3.190 Inches When All Other Conditions Are Met. Complete Sets Of Parts Consisting Of Two Screens And One Each Of Outlet And Inlet Spacers Must Be Added Or Removed To Obtain Desired Dimensions. Oil Outlet Spacer Must Be At Each End Of Stack.
2. PN 317029 Outlet Spacer, 28 Required
3. PN 429238 Screen, 58 Required
4. PN 317028 Inlet Spacer, 29 Required
5. PN 699147 Outlet Spacer. Install As Outlet Spacer At This End
6. Slot
7. Bushing
8. Complete Sets Of Parts Consisting Of Two Screens And One Of Inlet And Outlet Spacers Must Be Added Or Removed, If Required, So That Screens And Spacers Cannot Be Rotated By Hand When No. 9 Nut Is Tightened With Torque Sufficient To Seat It Solidly Against No. 7 Bushing As Visually Inspected Through No. 6 Slots.
9. Nut
10. Seat Assembly
11. Bypass Valve
12. Spring
13. 0.575 Inch Reference Before Application Of Torque
14. PN 523550 Outlet Spacer. Install As Outlet Spacer At No. 13 Location
15. Strainer Sleeve Assembly

Key to Figure 201 (Sheet 2)

R
R

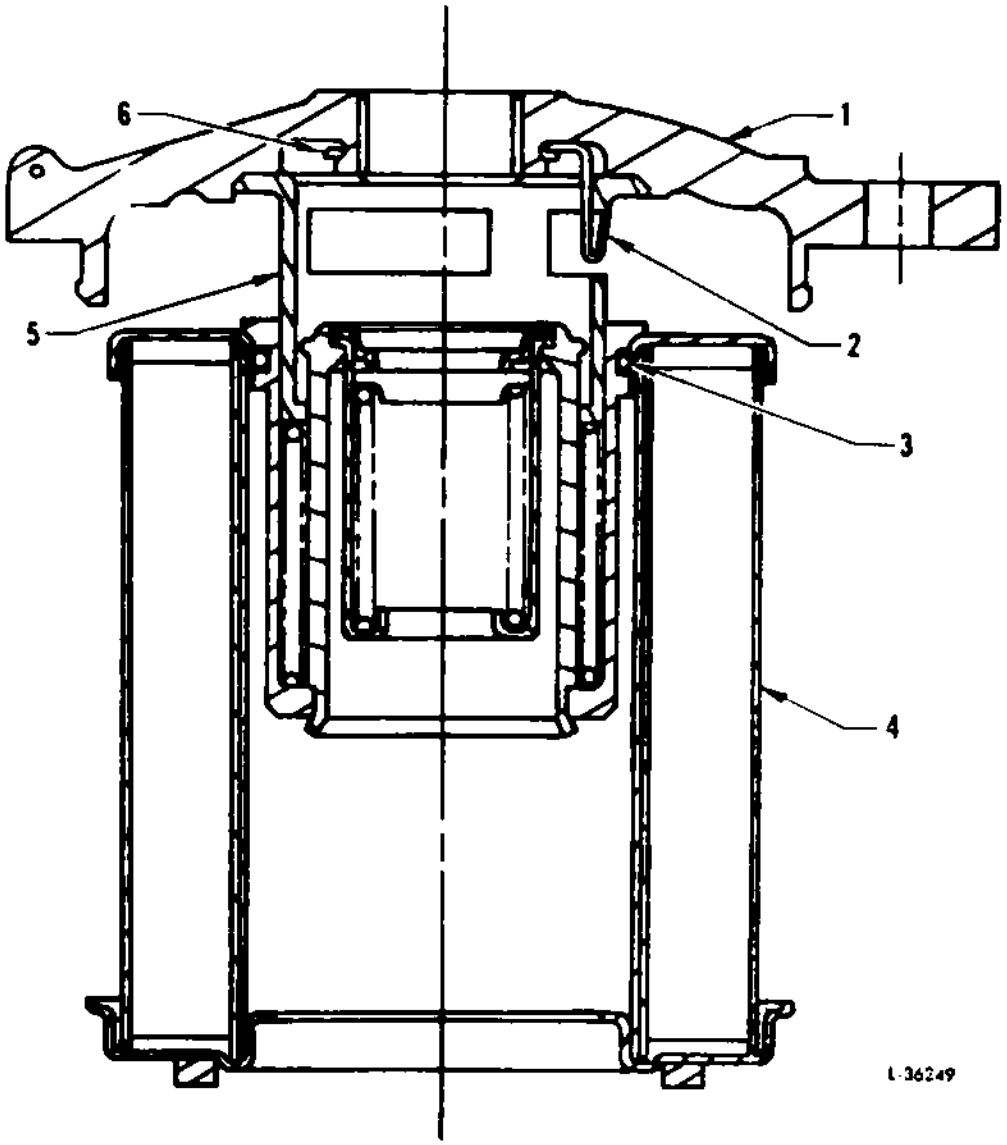


1. Strainer Element
2. Element Retainer Nut
3. Pressure Relief Valve
4. Oil Strainer Sleeve
5. O-Ring

R 6. Element Assembly

7. O-Ring
8. Relief Valve Spring

40 Micron-Type Oil
Strainer Element
Figure 201 (Sheet 3)
(Task 72-61-53-990-001)



1. Cover
2. PN 695398 Keywasher
3. MS9388-030 Packing

R 4. Filter Element Assembly

5. PN 710170 Pressure Relief Valve
6. PN 695399 Retaining Ring

R Main Oil Filter
R (15/70 Micron-Type)
Figure 201 (Sheet 4)
(Task 72-61-53-990-001)

Task 72-61-53-990-002:

1. Main Oil Strainer

See Figure 601.

A. Fits and Clearances (For General Information, See 72-00-00, Engine - Removal/Installation)

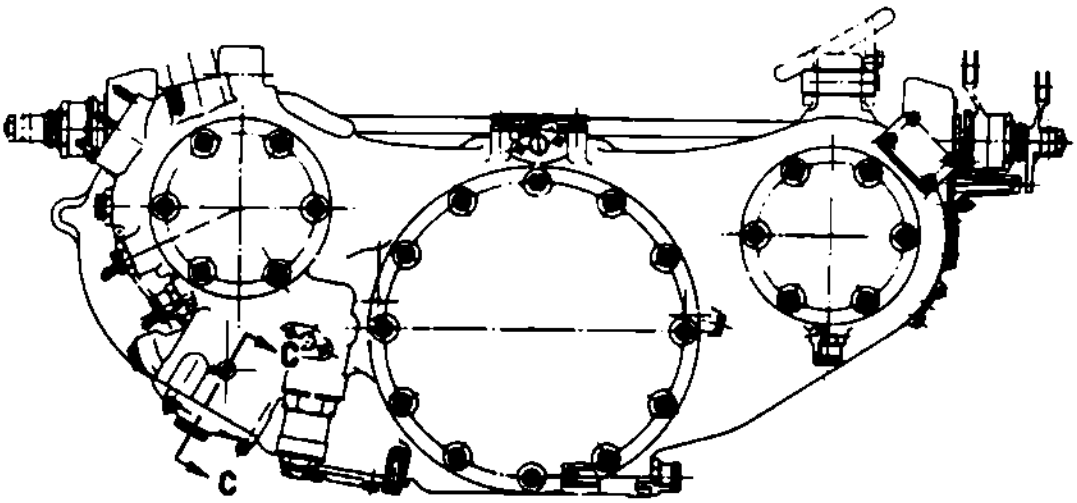
REF. NO.	DESCRIPTION	REF. DIMENSIONS MIN	REF. DIMENSIONS MAX	LIMITS MIN	LIMITS MAX	REPLACE IF OVER
1432	Pressure Relief Valve Oil Strainer Cover	1.895 1.910	1.905 1.930	 .005	 .035	

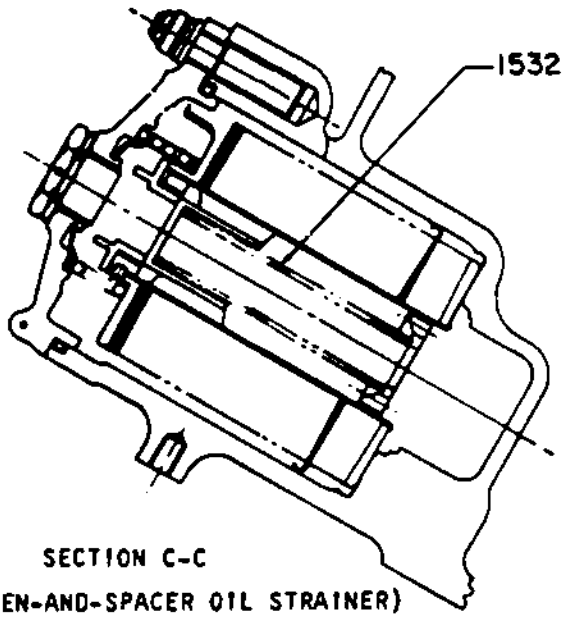
B. Special Torques

REF NO.	DESCRIPTION	LIMITS MIN	LIMITS MAX	REPLACE IF OVER
1477	Oil Sleeve Strainer Element Retaining Nut	40	50	

C. Spring Loads

REF NO.	DESCRIPTION	LIMITS MIN	LIMITS MAX	REPLACE IF OVER
1532	Main Oil Strainer Bypass Valve - Spring At 2.800 In.	33.381	36.819	31.6625



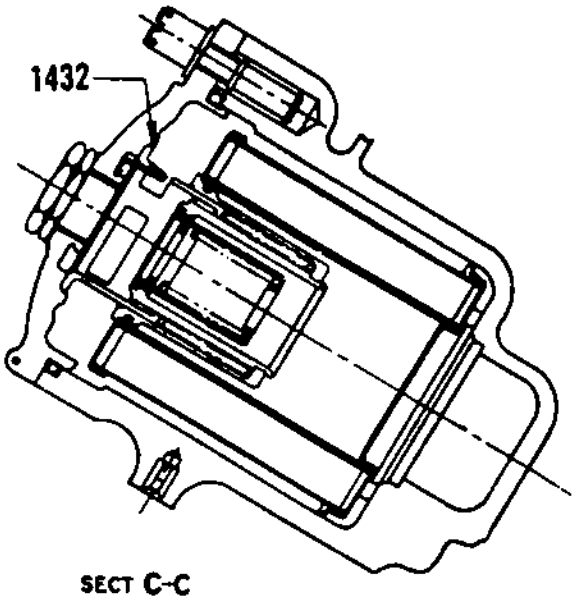


2-6108 A-69

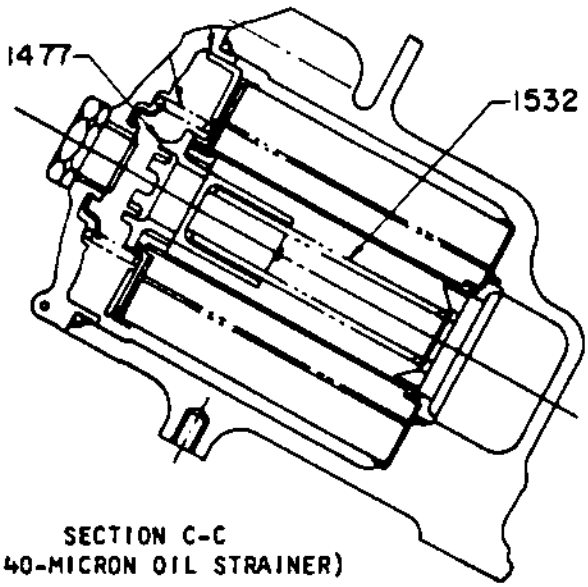
SECTION C-C
(SCREEN-AND-SPACER OIL STRAINER)

L-H2289

Main Oil Strainer (2-6108A-69)
Figure 601 (Sheet 1)
(Task 72-61-53-990-002)



SECT C-C
15 MICRON OIL FILTER



SECTION C-C
(40-MICRON OIL STRAINER)

2-6108 8-69

L-H2290

Main Oil Strainer (2-6108B-69)
Figure 601 (Sheet 2)
(Task 72-61-53-990-002)

Task 72-61-53-110-001:

1. Cleaning the Main Oil Strainer

A. Screen and Spacer Oil Strainer

(1) Loosen screens from spacers and separate parts along the rod. Immerse for few minutes in an approved carbon remover at room temperature.

(2) Rinse parts in a degreaser and blow dry with air. Refer to SPOP 209 (Task 70-00-00-100-003). See Chapter/Section 70-00-00 Cleaning/Painting-03, Standard Practices.

(3) Examine parts for cleanliness. Repeat steps (1) through (3) as necessary.

B. Oil Strainer: 40 Micron-Type (SB 2089)

NOTE: Before a 40 micron-type oil strainer is cleaned, disassemble it by Section 72-61-53, Maintenance Practices-00. Remove and discard the packings.

(1) To clean a 40-micron oil strainer it is necessary to do chemical and/or ultrasonic procedures. Refer to the JT8D Engine Manual PN 481672, Chapter/Section 72-61-55, Cleaning-01.

POWER LEVER CROSS SHAFTS - REMOVAL/INSTALLATION-00

Task 72-61-58-430-001:

1. Removal/Installation of Power Lever Cross Shafts

A. Removal

(1) Remove fuel control shut-off linkage arm and fuel control power linkage arm from power lever cross shafts.

(2) Unclinch tabwasher. Using PWA 12155 Holder, and PWA 12156 Wrench, remove bearing retaining nut from outer shaft at linkage arm side.

(3) Slide short sleeve spacer out. Pull power lever cross shafts assembly out from left hand side of gearbox cover.

NOTE: If necessary, tap gently on inner cross shaft to aid in removal.

(4) Remove linkage arm stop and power lever shaft plate. Pull out bearings and spacer.

NOTE: Power lever cross shafts equipped with fluorocarbon plastic coated journal bearings have only one bearing and no spacer.

B. Disassembly

(1) Secure outer power lever cross shaft in fixture or vise with lead lined jaws.

(2) Remove nut and spacer from outer shaft.

(3) Unclinch tabwasher. Using PWA 12156 Wrench, remove bearing retaining nut from outer shaft. Pull off tabwasher and spacer.

(4) Remove bearings and spacer from outer shaft.

NOTE: Power lever cross shafts equipped with fluorocarbon plastic coated journal bearings have only one bearing and no spacer.

(5) Using PWA 12153 Holder and standard wrench, remove nut and spacers from inner shaft.

(6) Unclinch tabwashers. Using holder and PWA 12154 Wrench, remove one of bearing retaining nuts, then pull out inner shaft from opposite end. Remove bearings and spacer from inside outer shaft.

NOTE: If necessary, tap gently on inner shaft to aid removal.

NOTE: Power lever cross shafts equipped with fluorocarbon plastic coated journal bearings have only one bearing and no spacer.

(7) Using wrench and holder, remove bearing retaining nut. Remove bearings and spacer from inner shaft.

NOTE: Power lever cross shafts equipped with fluorocarbon plastic coated journal bearings have only one bearing and no spacer.

C. Assembly - Ball Bearing Type
See Figure 401.

(1) Secure inner power cross shaft (10) in fixture or vise with lead lined jaws.

(2) Install bearing (31) and seat with PWA 12151 Drift.

(3) Position long sleeve spacer (32) over shaft and install bearing (33). Seat bearing against spacer using drift.

(4) Position short sleeve spacer (34) over shaft. Place keywasher (35) on shaft and thread nut (36) on handtight. Using PWA 12154 Wrench, torque to Inspection/Check-00, Reference 1456. Bend keywasher tab.

(5) Install spacer (37), spacer (38) and nut (39). Torque nut to Inspection/Check-00, Reference 1458. Lockwire nut. Remove shaft from vise.

(6) Secure outer power control shaft (22) in fixture or vise with lead lined jaws, long spline end in vise.

(7) Install assembled inner shaft into ID of outer shaft from short spline end.

(8) Install bearing (9) and seat with drift.

(9) Position long sleeve spacer (8) over shaft and install bearing (7). Seat bearing against spacer using drift.

(10) Position short sleeve spacer (6) over shaft. Place key- washer (5) on shaft and thread nut (4) on handtight. Using PWA 12153 Holder and wrench, torque to Inspection/Check-00, Reference 1456,

(11) Install shim (or shims) (40) behind inner bearing as necessary to obtain shaft end play specified in Inspection/Check-00 Reference 1011. Use either PN 596558 shim of sufficient classified thickness, or up to three PN 517877 shims. Bend key washer tab.

NOTE: PN 517877 shims are 0.018 - 0.022 inch thick and consist of laminations 0.002 inch thick.

(12) Install bearing (23) on small spline end of outer shaft. Position long sleeve spacer (24) over shaft and install bearing (25). Using PWA 12152 Drift, seat bearings and spacer.

(13) Position short sleeve spacer (26) over shaft. Place key washer (27) on shaft and thread nut (28). Using PWA 12156 Wrench, tighten to Inspection/Check-00, Reference 1459. Bend key washer tab.

(14) Install spacer (29) and nut (30) on shaft. Torque nut to Inspection/Check-00, Reference 1457. Lockwire nut. Remove shafts from vise.

D. Assembly - Fluorocarbon Plastic Coated Journal Bearing Type See Figure 402.

(1) Secure inner power cross shaft (9) in fixture or vise with lead lined jaws.

(2) Install bearing (27), with larger OD in, and seat with PWA 12151 Drift.

(3) Position short sleeve spacer (28) over shaft. Position key washer (29) on shaft and thread nut (30) on handtight. Using PWA 12154 Wrench, torque to Inspection/Check-00. Reference 1456. Bend key washer tab.

(4) Install spacer (31), spacer (32) and nut (33). Torque nut to Inspection/Check-00 Reference 1458. Lockwire nut. Remove shaft from vise.

(5) Secure outer power control shaft (20) in fixture or vise with lead lined jaws, long spline end in vise.

(6) Install assembled inner shaft into ID of outer shaft from short spline end.

(7) Install bearing (7), with larger OD in, and seat with drift.

(8) Position short sleeve spacer (6) over shaft. Place key washer (5) on shaft and thread nut (4) on handtight. Using PWA 12153 Holder and wrench, torque to Inspection/Check-00, Reference 1456.

(9) Install shim (or shims) (8) behind bearing as necessary to obtain shaft end play specified in Inspection/Check-00, Reference 1011. Use either PN 596558 shim of sufficient classified thickness, or up to three PN 517877 shims. Bend key washer tab.

NOTE: PN 517877 shims are 0.018 - 0.022 inch thick and consist of laminations 0.002 inch thick.

(10) Install bearing (21), with OD groove in, on smaller spline end of outer shaft. Using PWA 12152 Drift, seat bearing.

(11) Position short sleeve spacer (22) over shaft. Place key washer (23) on shaft and thread nut (24) on handtight. Using PWA 12156 Wrench, tighten to Inspection/Check-00, Reference 1459. Bend key washer tab.

(12) Install spacer (25) and nut (26) on shaft. Torque nut to Inspection/Check-00, Reference 1457. Lockwire nut. Remove shafts from vise.

E. Power Lever Cross Shafts (With Ball Bearings) - Installation in Gearbox
See Figure 401.

(1) Install bearing (21) into right hand side of gearbox cover.

(2) Insert longer spline end of assembled power lever cross shafts into left side of gearbox cover, carefully guiding it through bearing (21).

NOTE: Hold bearing with PWA 12152 Drift to keep it from falling out.

(3) Position long sleeve spacer (20) over shaft and install bearing (19). Seat bearing against spacer.

(4) Install power lever shaft plate (18), over shaft, and fuel control linkage arm stop (17), secure with nuts. Install screw in remaining hole and secure with washer, nut, and cotterpin.

(5) Position short sleeve spacer (16) over shaft to seat against bearing. Place key washer (15) on shaft and thread nut (14) on hand tight. Using PWA 12155 Holder and PWA 12156 Wrench, tighten to Inspection/Check-00, Reference 1459.

(6) Select and install proper class shim (41) (SB 2061) to obtain shaft end play. For engines using multiple laminated shims, install one to three shims as necessary to obtain shaft end play. For both types of shims, see Section 72-61-00, Inspection/Check-00, Reference 1010. Bend key washer tab.

NOTE: Laminated shims are 0.018 - 0.022 inch thick and consist of laminations 0.002 inch thick.

(7) Install the fuel control power linkage arm (13) into the outer shaft, offset clevis toward the gearbox. Install spacer (12) and nut (11). Tighten to torque given in Inspection/Check-00, Reference 1457 and lockwire.

(8) Install the fuel control shut-off linkage arm (3) into the inner shaft, offset clevis away from the gearbox. Install spacer (2) and nut (1). Tighten to torque given in Inspection/Check-00, Reference 1458 and lockwire.

F. Power Lever Cross Shafts (With Fluorocarbon Plastic Coated Journal Bearings) - Installation in Gearbox
See Figure 402.

(1) Install bearing (19) into right hand side of gearbox cover.

(2) Insert longer spline end of assembled power lever cross shafts into left side of gearbox cover, carefully guiding it through bearing (19).

NOTE: Hold bearing with PWA 12152 Drift to keep it from falling out.

(3) Install power lever shaft plate (17), over shaft, and fuel control linkage arm stop (16), secure with nuts. Install screw in remaining hole and secure with washer, nut, and cotterpin.

(4) Position short sleeve spacer (15) over shaft to seat against bearing. Place key washer (14) on shaft and thread nut (13) on hand tight. Using PWA 12155 Holder and PWA 12156 Wrench, tighten to torque given in Inspection/Check-00, Reference 1459.

(5) Select and install proper class shim (18) (SB 2061) to obtain shaft end play. For engines using multiple laminated shims, install one to three shims as necessary to obtain shaft end play. For both types of shims, see Inspection/Check-00, Reference 1010. Bend key washer tab.

NOTE: Laminated shims are 0.018 - 0.022 inch thick and consist of laminations 0.002 inch thick.

(6) Install the fuel control power linkage arm (12) into the outer shaft, offset clevis toward the gearbox. Install spacer (11) and nut (10). Tighten to torque given in Inspection/Check-00, Reference 1457 and lockwire.

(7) Install the fuel control shut-off linkage arm (3) onto the inner shaft, offset clevis away from the gearbox. Install spacer (2) and Nut (1). Tighten to torque given in Inspection/Check-00, Reference 1458 and lockwire.

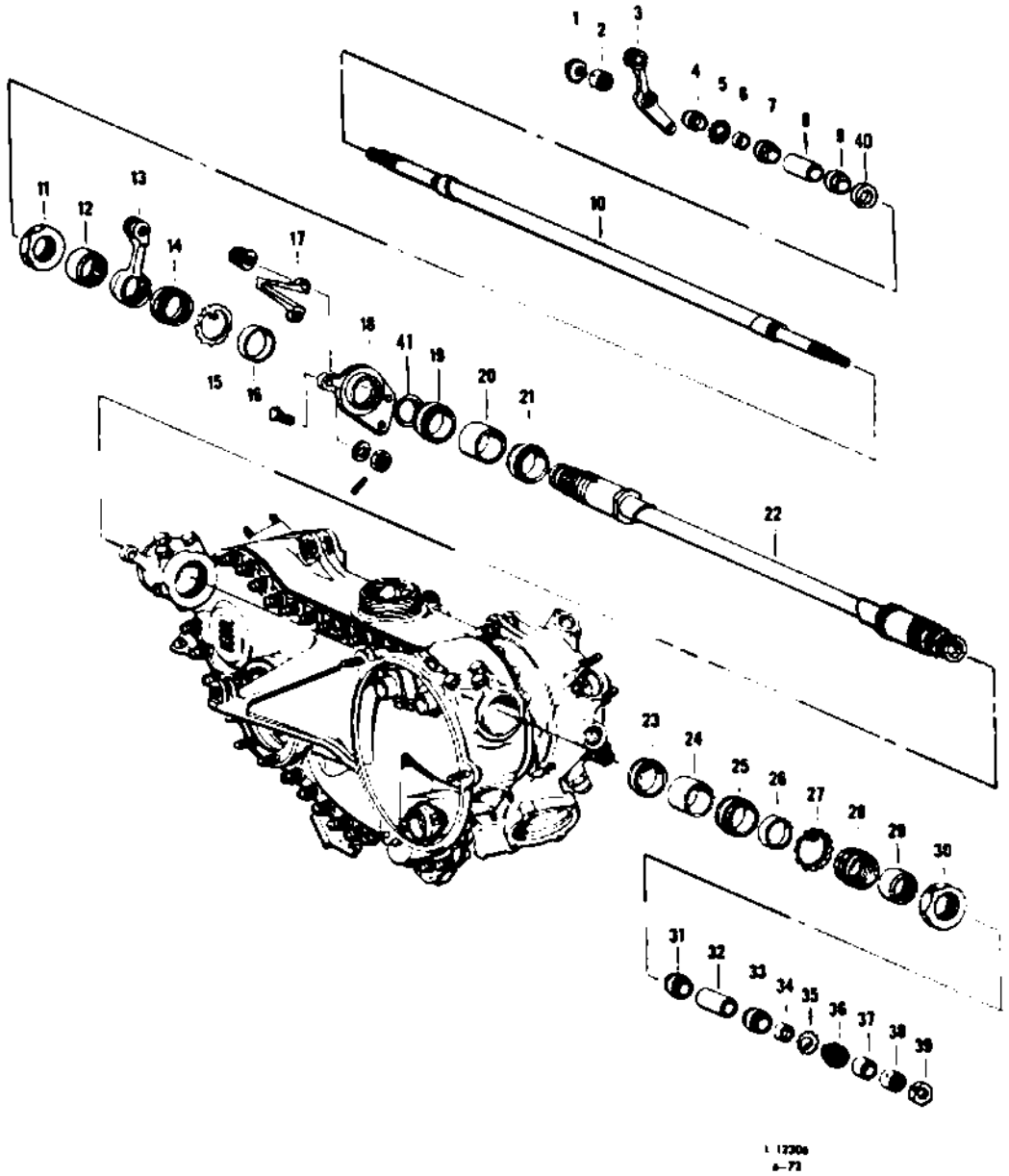
G. Test Engine

(1) Test engine per "Repair Reference Table", in Engine General - Adjustment/Test.

H. Numerical Tool List

POWER LEVER CROSS SHAFTS - REMOVAL/INSTALLATION-00

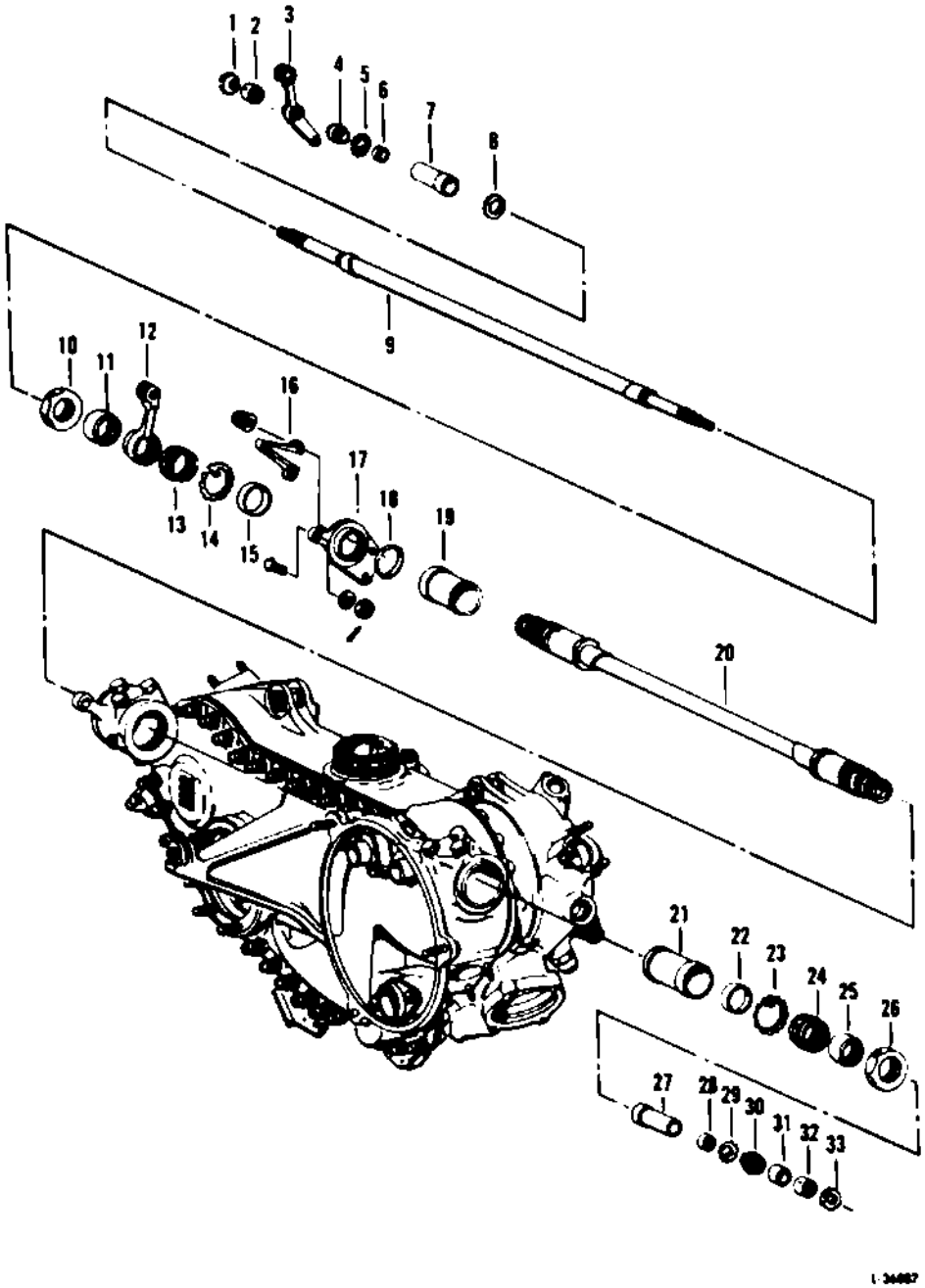
PWA 12151	Drift - Power Lever Cross Shaft Inner Bearings
PWA 12152	Drift - Power Lever Cross Shaft Outer Bearings
PWA 12153	Holder - Inner Shaft
PWA 12154	Wrench - Inner Shaft Bearing Retaining Nut
PWA 12155	Holder - Outer Shaft
PWA 12156	Wrench - Outer Shaft Bearing Retaining Nut



Power Lever Cross Shafts
(With Ball Bearings)
Figure 401
(Task 72-61-58-430-001)

1. Nut
2. Spacer
3. Arm - Fuel Control Shutoff
4. Nut
5. Key Washer
6. Spacer
7. Bearing
8. Spacer
9. Bearing
10. Shaft - Inner
11. Nut
12. Spacer
13. Arm - Fuel Control Power Linkage
14. Nut
15. Key Washer
16. Spacer
17. Stop
18. Plate
19. Bearing
20. Spacer
21. Bearing
22. Shaft - Outer
23. Bearing
24. Spacer
25. Bearing
26. Spacer
27. Key Washer
28. Nut
29. Spacer
30. Nut
31. Bearing
32. Spacer
33. Bearing
34. Spacer
35. Key Washer
36. Nut
37. Spacer
38. Spacer
39. Nut
40. Shim
41. Shim

Key to Figure 401



Power Lever Cross Shafts
(With Fluorocarbon Plastic
Coated Journal Bearings)
Figure 402
(Task 72-61-58-430-001)

1. Nut
2. Spacer
3. Arm - Fuel Control Shutoff
4. Nut
5. Key Washer
6. Spacer
7. Bearing
8. Shim
9. Shaft - Inner
10. Nut
11. Spacer
12. Arm - Fuel Control Power Linkage
13. Nut
14. Key Washer
15. Spacer
16. Stop
17. Plate
18. Shim
19. Bearing
20. Shaft - Outer
21. Bearing
22. Spacer
23. Key Washer
24. Nut
25. Spacer
26. Nut
27. Bearing
28. Spacer
29. Key Washer
30. Nut
31. Spacer
32. Spacer
33. Nut

Key to Figure 402

POWER LEVER CROSS SHAFTS - INSPECTION/CHECK-00

Task 72-61-58-990-001:

1. Power Lever Cross Shafts

See Figure 601.

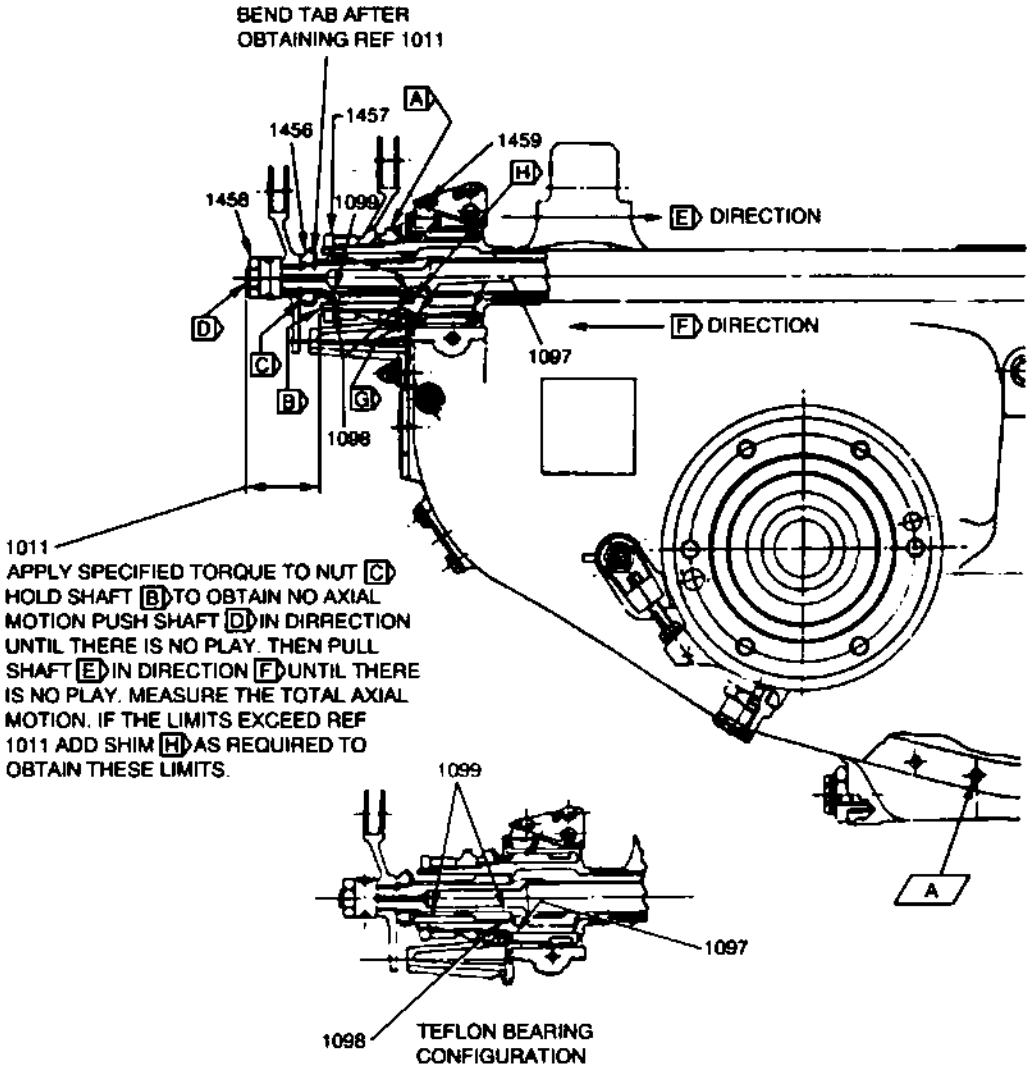
A. Fits and Clearances (For General Information, See 72-00-00, Engine - Removal/Installation-00)

REF. NO.	DESCRIPTION	REF. DIMENSIONS MIN	REF. DIMENSIONS MAX	LIMITS MIN	LIMITS MAX	REPLACE IF OVER
1011	Gearbox Inner Cross Shaft Axial Motion			.005	.010	.012
1097	Power Lever Cross Shaft Outer	1.5605	1.5615			
	Bearing (ID)	1.5618	1.5632	.0003	.0027	.0027
1098	Ball Bearing (OD)	1.0615	1.0625			
	Power Lever Cross Shaft Outer	1.0625	1.0635	.000	.002	.0022
	Teflon Bearing OD PN s 706105A and 709677A and later	1.0585	1.0600			
	Power Lever Cross Shaft Outer	1.0625	1.0635	.0025	.005	.005
	Teflon Bearing OD Prior to above	1.0605	1.0615			
	Power Lever Cross Shaft Outer	1.0625	1.0635	.001	.003	.003
1099	Power Lever Cross Shaft, Inner	.623	.624			
	Bearing (ID)	.6243	.6257	.0003	.0027	.0027

B. Special Torque Limits

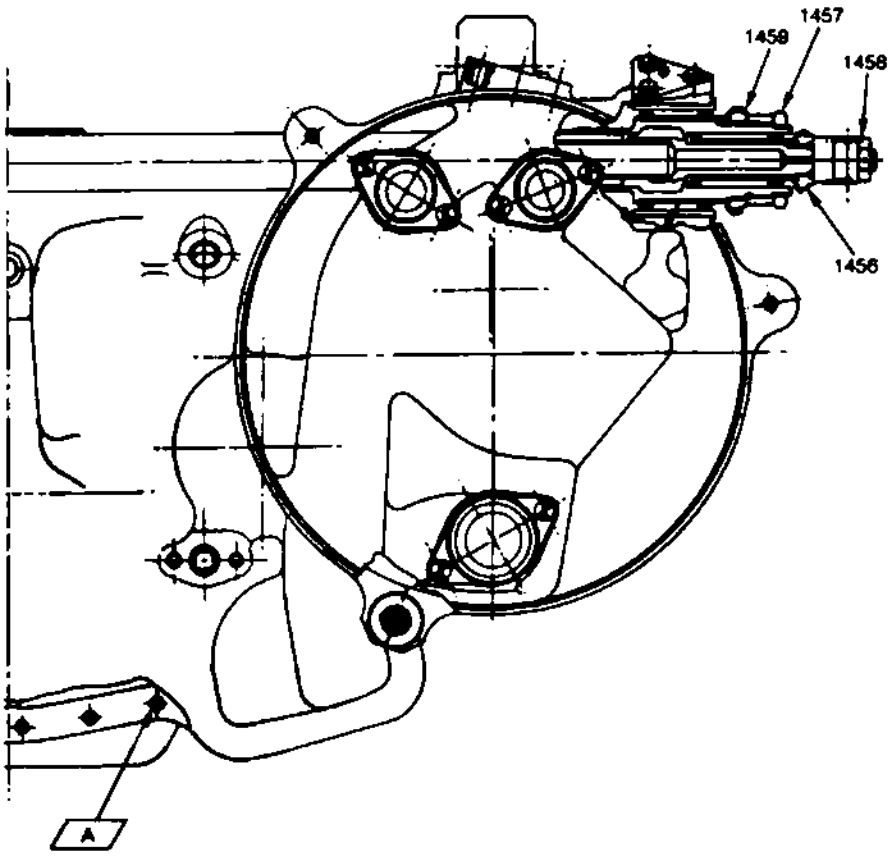
POWER LEVER CROSS SHAFTS - INSPECTION/CHECK-00

REF NO.	DESCRIPTION	LIMITS MIN	LIMITS MAX	REPLACE IF OVER
1456	Cross Shaft Spanner Nut (Tighten to 100 lb-in. then turn to next locking position)			
1457	Fuel Control Power Linkage Arm Retaining Nut	225	300	
1458	Cross Shaft Lever Locking Nut	65	100	
1459	Cross Shaft Spanner Nut (Tighten to 375 lb-in., then turn to next locking position)			



L-H4805X (0601)
PW C

Power Lever Cross
Shafts (1-6110A-69)
Figure 601 (Sheet 1)
(Task 72-61-58-990-001)



L-H480SY (0601)
PW C

Power Lever Cross
Shafts (1-6110A-69)
Figure 601 (Sheet 2)
(Task 72-61-58-990-001)

FUEL CONTROL AND FUEL PUMP PAD BRACKET - REPAIR-00

Task 72-61-63-300-001:

1. Quick-Disconnect Nut

A. Locking Bolt Replacement
See Figure 801.

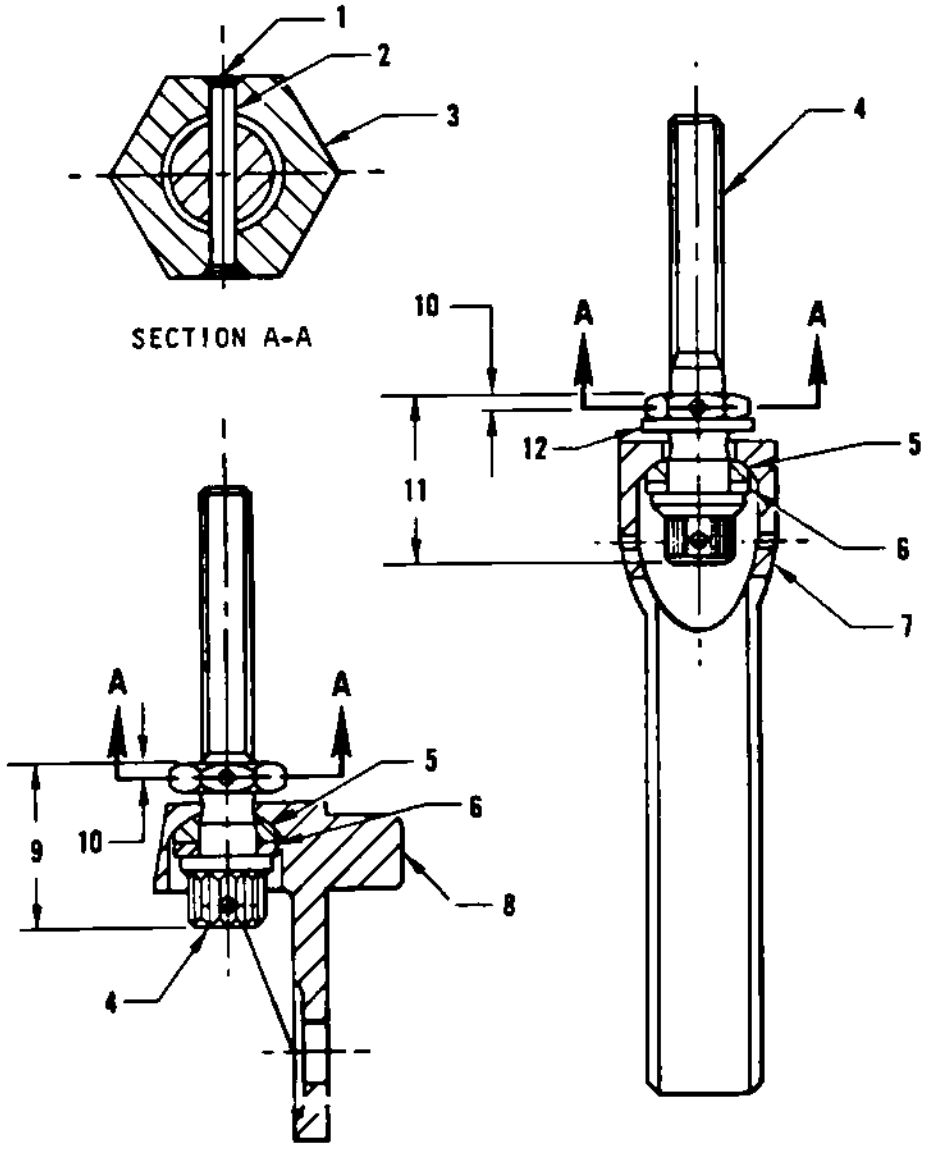
(1) Drive out pin from nut and remove nut from bolt. Remove bolt from quick-disconnect nut assembly (or from fuel pump pad bracket if so equipped) together with washers.

NOTE: SB 1095 relocates fuel pump quick-disconnect locking bolt from bracket on pad to rotating nut assembly. See figure for position of detail parts for either type.

(2) Reassemble bolt, spherical washer, flat washer, and nut. Position these assembled parts on PWA 12619 Jig (PWA 8087 for assemblies prior to SB 1095), aligning nut against body of tool and turning bolt until head touches stop. Drill nut and/or bolt as needed, maintaining dimensions given in figure.

NOTE: If either bolt or nut has been previously used and does not require drilling, pilot drill through hole in reused nut (or align reused bolt by means of reference mark) to avoid enlarging holes or weakening parts.

(3) Remove assembly from jig, disassemble, and reassemble on quick-disconnect nut (or bracket) as shown in figure. Drift pin into nut as shown and stake each end.



Quick-Disconnect Bolt Assembly
Figure 801
(Task 72-61-63-300-001)

1. Drill 0.060 - 0.065 Inch Diameter Through, Chamfered 113 - 123 Degrees Inclusive to 0.090 - 0.110 Inch Diameter At Both Ends, Located Within 0.005 Inch Of True Position.
2. Straight Pin. Stake At Both Ends.
3. Locknut
4. Bolt
5. Spherical Washer
6. Washer
7. Quick-Disconnect Nut
8. Fuel Pump Pad Bracket
9. 0.750 - 0.770 Inch
10. 0.067 Inch
11. 0.880 - 0.900 Inch
12. Washer

Key to Figure 801

FAN DISCHARGE SECTION - DESCRIPTION-00

Task 72-70-00-990-003:

1. Fan Discharge Section

See Figure 1.

A. Behind the fan exit case, and enclosing the engine, is a series of fan discharge outer ducts and cases. These outer ducts and the outside surface of the inner ducts and inner engine cases form the annular duct air passage for fan discharge air to flow to the rear of the engine.

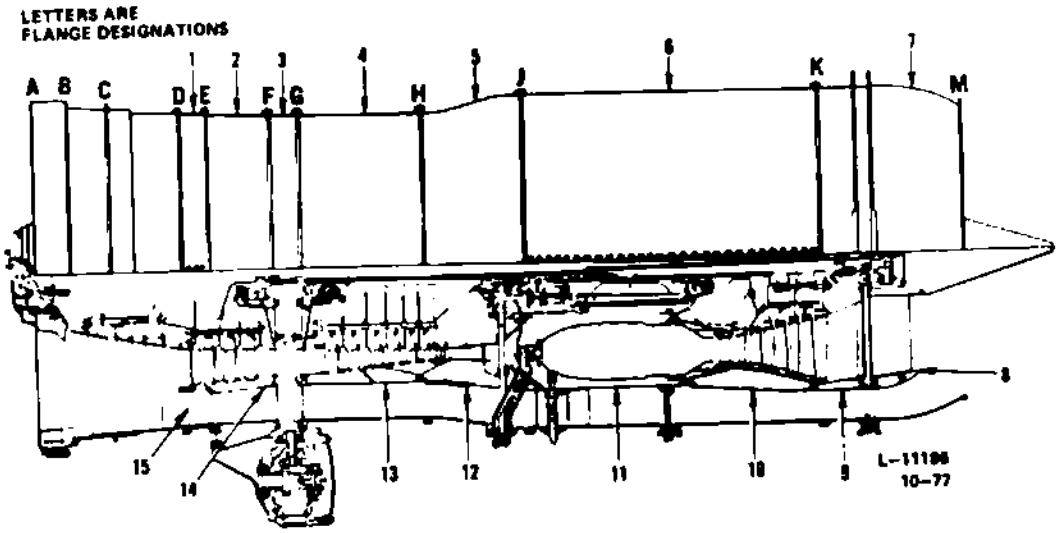
Task 72-70-00-990-004:

2. Fan Discharge Case Assembly (and Fan Discharge Vanes)

A. Bolted to the rear flange of the fan rear case is the fan exit case, extending from Flange D to E. This case incorporates matched upper and lower halves of aluminum, bolted together. Each half has 28 aluminum vanes brazed to an inner shroud and the outer case wall, with aluminum plugs at the outer end.

B. A rectangular hole at the mating surfaces, nine o'clock position, of the case matches a pin flared in place on the rear flange of the front compressor case.

FAN DISCHARGE SECTION - DESCRIPTION-00



1. Fan Discharge Front Case
2. Fan Discharge Front Compressor Outer Duct
3. Fan Discharge Intermediate Case
4. Fan Discharge Rear Compressor Section Outer Duct
5. Fan Discharge Diffuser Section Outer Duct
6. Fan Discharge Combustion Section Outer Duct
7. Fan Discharge Turbine Exhaust Section Outer Duct
8. Fan Discharge Turbine Exhaust Inner Rear Duct
9. Fan Discharge Turbine Exhaust Inner Front Duct
10. Fan Discharge Turbine Section Inner Duct
11. Combustion Chamber Outer Case
12. Fan Discharge Diffuser Section Inner Duct
13. Fan Discharge Rear Compressor Section Inner Duct
14. Compressor Intermediate Case
15. Fan Discharge Vanes

Fan Discharge Ducting
Figure 1
(Task 72-70-00-990-004)

Task 72-70-00-990-001:

1. General

A. Keep airframe air ducting and fan discharge ducting free of dirt, oil, and grease, and remove all loose parts (such as nuts, washers, and pieces of lockwire) and foreign matter. Do not step or stand on fan discharge ducts.

Task 72-70-00-430-001:

2. Removal/Installation of Rear Compressor Low Pressure Air Transfer Tubes (Left and/or Right Side)

NOTE: There are two air transfer tubes on each side of rear compressor outer duct. Removal and installation is same for either side.

A. Removal

(1) Remove airframe manifold (or cover) from low pressure sixth stage bleed pad.

(2) Unfasten spiral retaining rings and remove two air transfer tubes.

B. Installation

(1) Install two new packings, lubricated with a thin layer of PWA 36500 Assembly Fluid in grooves of each air transfer tube.

(2) Install tubes (through openings in outer duct) down into boss in inner duct with groove in ID of tube outward.

CAUTION: DO NOT DISRUPT PACKINGS WHEN INSTALLING TUBES.

(3) Secure each of two tubes with spiral retaining ring.

(4) Using new gasket, install and secure cover or airframe manifold and associated parts on bleed pad.

Task 72-70-00-430-002:

3. Removal/Installation of Rear Compressor Air Bleed Manifolds (Left and/or Right Side Eighth Stage Air)

See Figure 201.

NOTE: There is one eighth stage air bleed manifold on each side of rear compressor outer duct. Removal/Installation is the same for either side.

A. Removal

(1) Remove engine anti-icing manifold and airframe manifold (or pad cover) from eighth stage bleed pad.

(2) Remove bolts holding rear compressor air bleed manifold to outer duct boss and remove manifold.

CAUTION: SLIDE MANIFOLD STRAIGHT OUT TO AVOID DAMAGE TO RINGS OR LINER AT INNER END.

(3) Remove expansion joint liner and spring.

(4) If engine incorporates expansion joint which is threaded in place, straighten crimps in keywasher; using PWA 12250 Wrench, unscrew and remove expansion joint sleeve and washer from inner duct.

B. Installation

(1) If engine incorporates expansion joint which is threaded in place, place new keywasher on bleed boss on rear compressor inner duct.

(2) Install threaded expansion joint sleeve on bleed boss. Using PWA 12250 Wrench, tighten sleeve to recommended torque and crimp keywasher (in five places) to secure sleeve.

(3) Install spring and metal seal ring in expansion joint liner and install liner down into sleeve.

NOTE: Seal rings that are manufactured with plasma coating on OD and on loaded side (side facing out of engine in operation) have "X" mark on uncoated side and should be installed so that "X" mark faces into engine when liner or manifold is installed. Seal rings, coated on

both sides or without coating, may face either way.

(4) Position new manifold gasket on outer duct boss.

(5) Position metal seal ring in air bleed manifold ring groove and install manifold into sleeve and against outer duct boss.

(6) Secure manifold with four bolts at this time.

(7) Reinstall engine anti-icing manifold, using longer bolts to secure both anti-icing elbow and air bleed manifold.

(8) Install gaskets. Install and secure airframe manifold and related parts (or pad cover) on bleed pad.

Task 72-70-00-430-003:

4. Removal/Installation of Diffuser Section Air Bleed Manifolds (Left and/or Right Side)

NOTE: Although left and right diffuser air bleed manifolds are not interchangeable, Removal/Installation is essentially the same for either side of engine.

A. Removal

(1) Remove exterior airframe and engine fuel anti-icing manifolds and/or covers from high pressure bleed pad, just above ten and/or two o'clock, on diffuser section outer duct.

(2) Unfasten bolts and slide out left and/or right diffuser section air bleed manifolds.

CAUTION: SLIDE MANIFOLD STRAIGHT OUT TO AVOID DAMAGE TO RINGS OR LINER AT INNER END.

(3) Remove expansion joint liner.

(4) Straighten the rim of the keywasher; then unscrew and remove the expansion joint sleeve using PWA 12398 Wrench and the washer from the inner duct.

B. Installation

(1) Place a new keywasher on the threaded boss on the diffuser case.

(2) Install threaded expansion joint sleeve in threaded boss. Using PWA-12398 Wrench, tighten sleeve then crimp keywasher to secure sleeve.

(3) Install metal seal ring in expansion joint liner; then install spring and liner down into sleeve.

NOTE: Seal rings that are manufactured with plasma coating on OD and on loaded side (side facing out of engine in operation) have "X" mark on uncoated side and should be installed so that "X" mark faces into engine when liner or manifold is installed. Seal rings, coated on both sides or without coating, may face either way.

(4) Install new manifold gasket on outer duct boss.

(5) Position metal seal ring in air bleed manifold ring groove and install manifold into liner and against outer duct boss.

(6) Secure left and/or right manifolds on engine with bolts.

CAUTION: MAKE CERTAIN EXPANSION JOINT LINER AND ITS RING ARE IN SLEEVE AND RING IN PLACE IN MANIFOLD BEFORE INSTALLING MANIFOLD.

(7) Using new gaskets, reinstall and secure exterior engine fuel de-icing and airframe manifolds and/or covers on high pressure bleed pads on diffuser section outer duct.

Task 72-70-00-430-004:

5. Removal/Installation of Combustion Section Fan Duct

A. Removal
See Section 72-40-00, Removal/Installation-00.

B. Duct Disassembly/Assembly (Engines Equipped With Optional Noise Attenuation Equipment)
See Figure 202.

(1) Remove screws and washers securing liners to ID of upper and lower ducts, and remove liners from ducts.

(2) Install liners in ducts as follows:

(a) Place washers, cap down, into screw holes with long screws into external locknuts and short screws into internal locknuts.

NOTE: To avoid losing parts into cavity between duct and liner during assembly, count out exact number of screws and washers required to install liners.

(b) Torque screws by first recording torque required to turn screw through locknut before seating screw. Then add this initial torque to 22 - 24 lbs.-in. and use this new value as total applied torque.

NOTE: To reduce tendency of liners to "walk" around duct ID as screws as installed, install screws first at ends (front and rear) of liner, then starting at middle, work toward ends.

C. Installation
See Section 72-40-00, Removal/Installation-00.

Task 72-70-00-430-005:

6. Removal/Installation of Combustion Chamber Drain Manifold and Fuel Drain Valves (Front and/or Rear)

See Figure 203.

A. Removal

(1) Remove any interfering airframe parts; then remove fuel drain manifold packing holder from bottom of combustion section fan duct. Remove combustion section lower fan duct guiding connector tube bosses over two drain tube connectors (or fuel drain manifold tube for engines incorporating SB 1154).

(2) Unfasten bolts holding combustion chamber fuel drain manifold or drain tube connectors (as equipped) to bottom of combustion chamber outer case.

(3) Remove fuel drain manifold on two drain tube connectors (as equipped) and two fuel drain valves.

B. Installation - Fuel Drain Manifold

(1) Inspect fuel drain valve assembly for correct gap setting. See Figure 204.

(2) Position fuel drain valve assemblies on front and rear bosses of combustion chamber outer case and finger valve cover on front boss.

CAUTION: MAKE CERTAIN THAT HOLES ARE PROPERLY ALIGNED WITH LOCATING PIN IN CASE.

(3) With seal in place on finger valve, position fuel drain manifold and secure with four gaskets and bolts at each end. Tighten bolts and lockwire.

(4) Lubricate two new packings with a thin layer of PWA 36500 Assembly Fluid. Install one in groove on forward drain valve cover and the other at lower end of fuel drain manifold lower end.

(5) Make certain that no tools or loose parts are inside ducts; then install combustion section lower fan duct and related parts.

(6) Install new packing in packing holder and install holder up over fuel drain manifold against lower duct boss. Install sleeve spacers, airframe bracket, and bolts, washers, and locknuts (washers and locknuts inboard). Tighten locknuts.

(7) Reinstall and secure airframe parts.

C. Installation - Drain Tubes Connectors (If so equipped).

(1) Position the fuel drain valve assembly and the combustion chamber drain tube connector on the boss at the bottom of the combustion chamber outer case, aligning the holes in the valve and connector with the pin in the boss.

CAUTION: MAKE CERTAIN THAT THE HOLES ARE PROPERLY ALIGNED WITH THE LOCATING PIN IN THE CASE.

(2) Secure drain valve and drain tube connector to case with four gaskets and bolts. Tighten bolts and lockwire.

(3) Make certain that no tools or loose parts are inside ducts; then install combustion section lower fan duct and related parts.

(4) Install new packing, lubricated with a thin layer of PWA 36500 Assembly Fluid or petrolatum, in groove of manifold fuel tube connector or of each fuel tube connector.

(5) Install new packing on manifold or in connector packing holder and install holder up over rear fuel drain tube connector against lower duct boss. Install four sleeve spacers, airframe bracket, and bolts, washers, and locknuts (washers and locknuts inboard). Tighten locknuts.

(6) For engines so equipped, install and secure packing and holder, sleeve spacers, bolts, washers, and locknuts on front fuel drain tube connector in same manner as given in previous step.

NOTE: If combustion chamber and turbine fan duct incorporating two fuel drain bosses is used with fuel drain manifold, front boss associated packing, bolts (4), washers (8), and locknuts (4).

(7) Reinstall and secure airframe parts.

Task 72-70-00-430-006:

7. Removal/Installation of the Rear Compressor Fairing Segments

A. Removal

(1) Remove exterior manifolds and/or covers from diffuser section outer duct.

(2) Unfasten bolts and slide out left and right diffuser air bleed manifolds and expansion joint liners.

(3) Remove bolts, washers, and locknuts holding segments to outer duct.

(4) Remove bolts, washers, and brace, then lockwire and hinge pin holding segments together.

(5) Remove fairing segments from duct.

B. Installation

(1) Position fan duct fairings (four segments) in duct just above ten and 2 o'clock position and secure fairing at each location.

(2) Secure fairing segments together with brace, screws, and two nuts inside, then hinge pin and lockwire and washer at rear. Torque screws and nuts and lockwire to secure.

(3) Install washers and bolts into outer duct pad (to hold the fairing to the duct) and secure with washers and locknuts inside. Tighten to recommended torque.

(4) Install metal seal ring in expansion joint liner, then in- stall liner and spring down into sleeve.

(5) Install new manifold gasket on outer duct boss.

(6) Position metal seal ring in air bleed manifold ring groove and install manifold into sleeve and against outer duct boss.

Task 72-70-00-430-007:

8. Removal/Installation of Left Spark Igniter Cable Fairing

A. Removal

(1) Unfasten bolts and remove left igniter cable fairing (8 o'clock position) from fan duct.

B. Installation

(1) Install left igniter cable fairing on rear of No. 4 bearing tubes fairing. Secure with four washers and bolts.

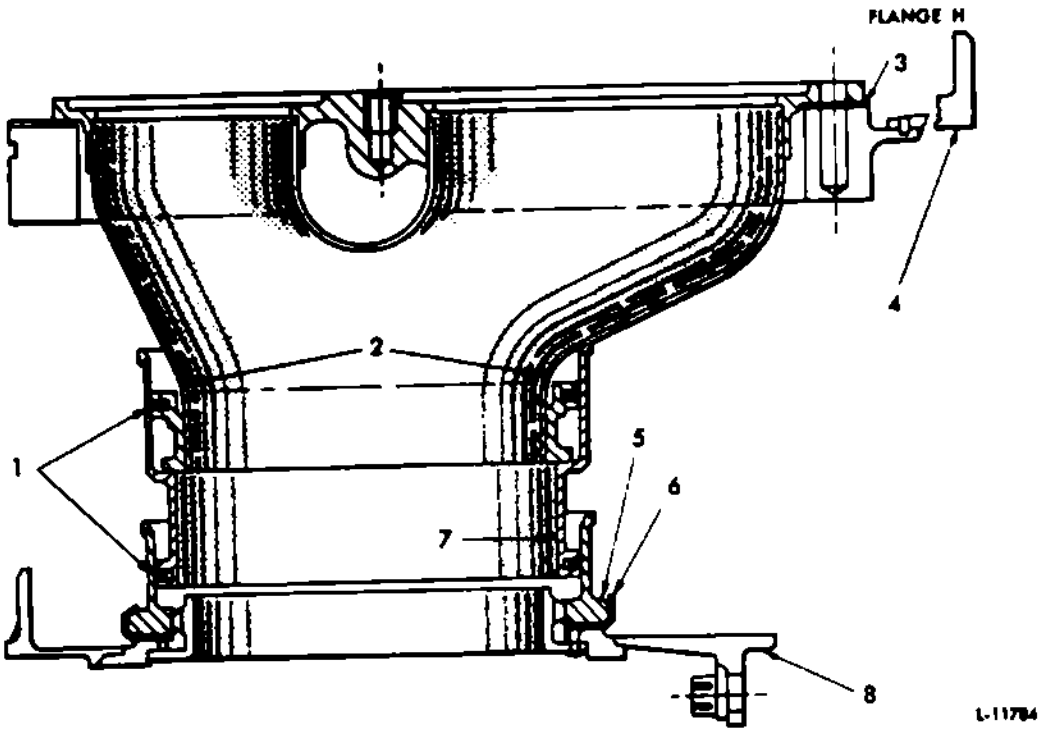
(2) Tighten bolts to recommended torque.

Task 72-70-00-990-002:

9. Numerical Tool List

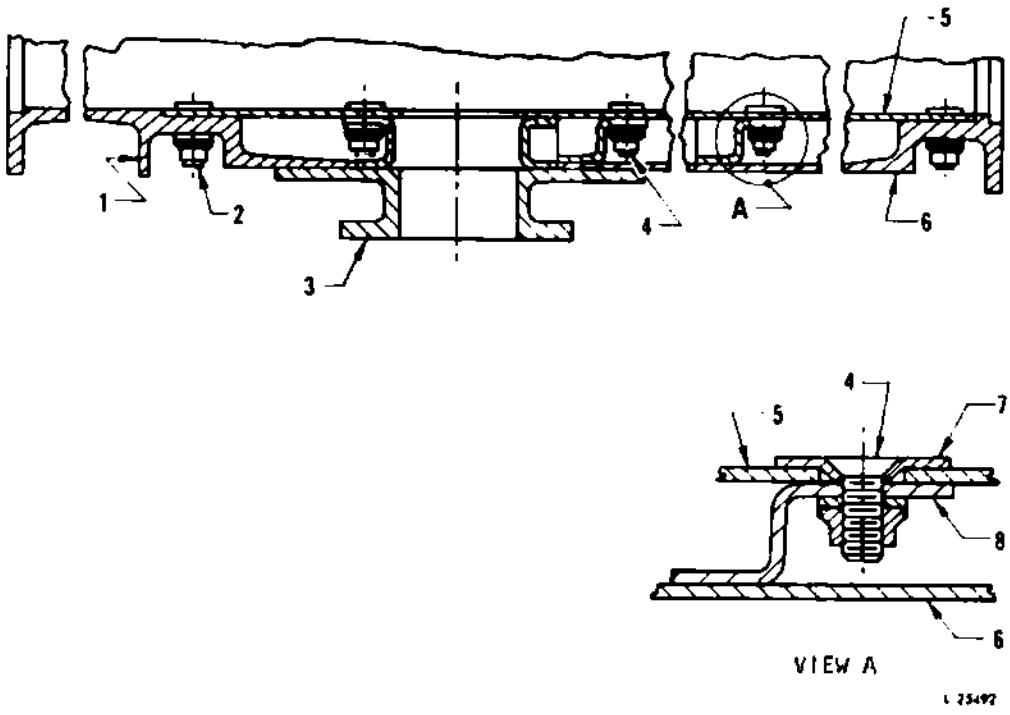
A.

PWA 12250	Wrench - Rear Compressor Air Supply Expansion Joint Sleeve
PWA 12398	Wrench - Diffuser Air Supply Expansion Joint Sleeve



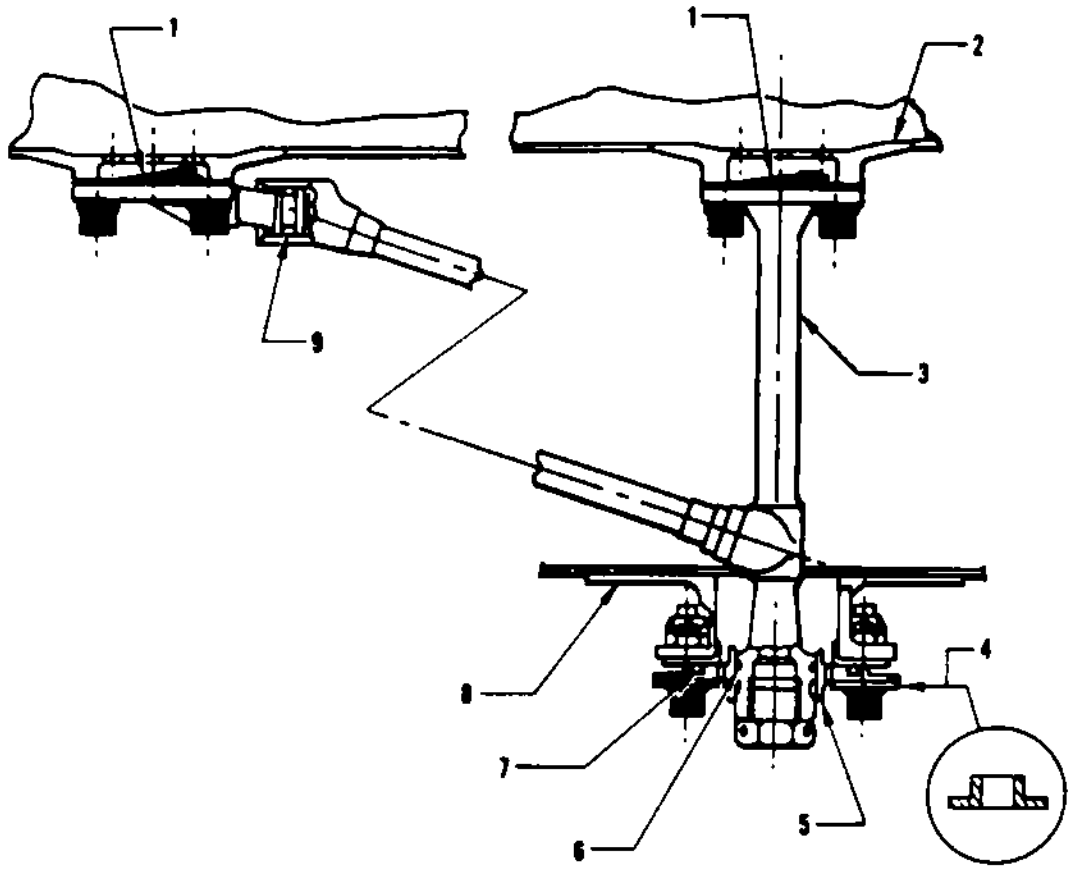
1. Metal Seal Rings
2. Rear Compressor Air Bleed Manifold
3. Manifold Gasket
4. Rear Compressor Outer Fan Duct
5. Expansion Joint Sleeve
6. Key Washer
7. Expansion Joint Liner
8. Rear Compressor Inner Fan Duct

Rear Compressor Air Bleed
Manifold (8th Stage Air)
Figure 201
(Task 72-70-00-990-002)



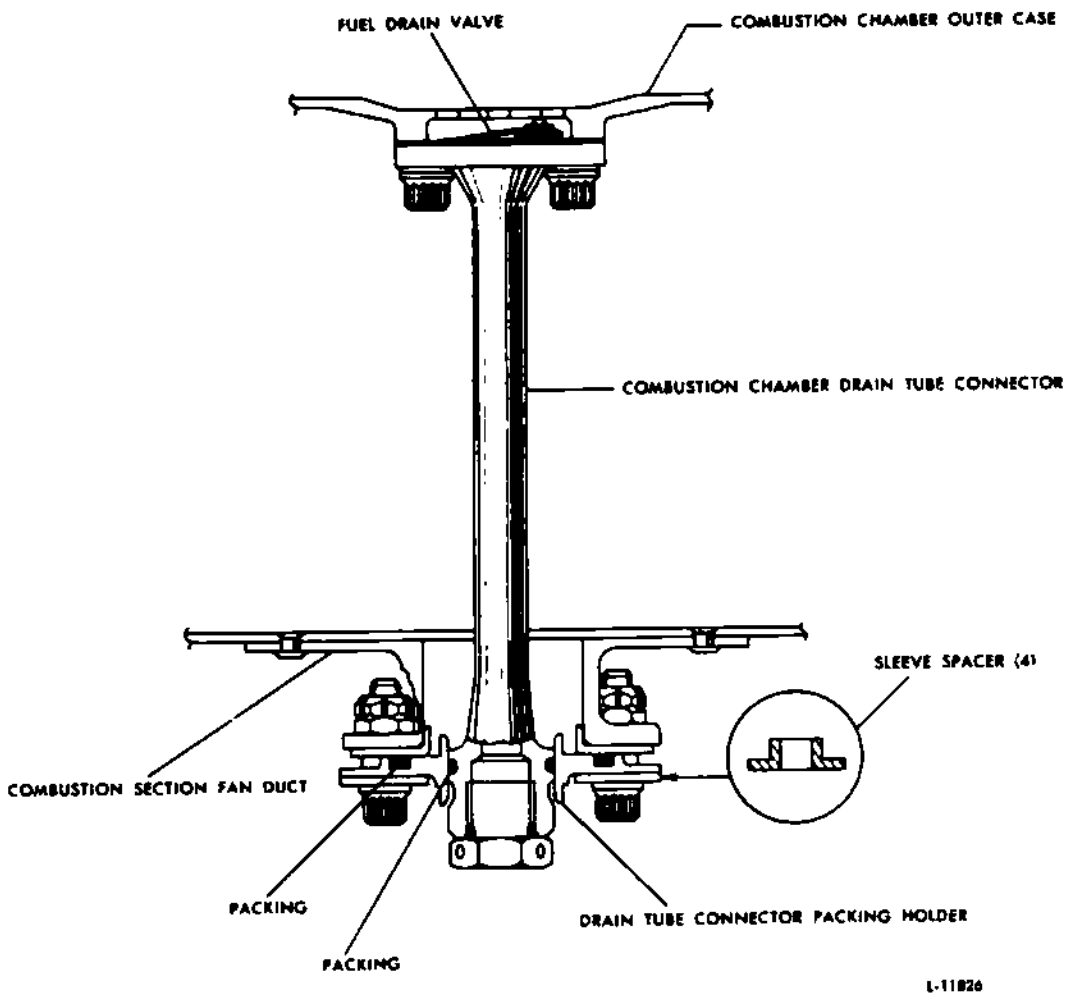
1. Flange J-1
2. Screw (Long)
3. Drain Boss
4. Screw (Short)
5. Liner
6. Combustion Chamber Fan Duct
7. Washer
8. Bracket

Combustion Section Fan Ducts
(For Engines Equipped With
Noise Attenuation Equipment)
Figure 202
(Task 72-70-00-990-002)

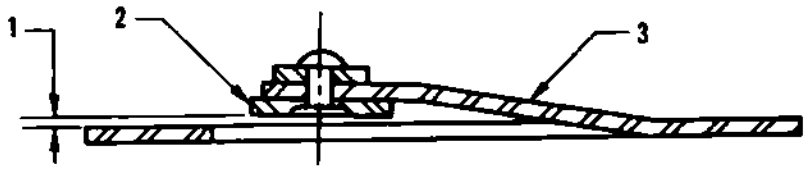


1. Fuel Drain Valve
2. Combustion Chamber Outer Case
3. Fuel Drain Manifold
4. Sleeve Spacer
5. Packing Holder
6. Packing
7. Packing
8. Combustion Section Fan Duct
9. Packing

Combustion Chamber Fuel Manifold
Figure 203 (Sheet 1)
(Task 72-70-00-990-002)



Combustion Chamber Drain Tube
Connectors (Prior to SB 1154)
Figure 203 (Sheet 2)
(Task 72-70-00-990-002)



L-25282 (0000)

1. See Reference 89 in Chapter/Section 72-00-00, Engine - Inspection/Check-02
2. Valve
3. Diaphragm

Fuel Drain Valve
Figure 204
(Task 72-70-00-990-002)

FAN DISCHARGE DUCTS AND CASES - DESCRIPTION-00

Task 72-71-00-990-001:

1. Fan Discharge Outer Ducts And Fairings

A. Fan Discharge Front Compressor Outer Duct

(1) The aluminum fan discharge front compressor outer duct is secured to the rear of the fan discharge front cases and forms the outer wall of the annular duct from flange E to F. Forming the inner wall is the front compressor section fan discharge inner duct extending forward from, and integral with, the compressor intermediate case assembly. The front compressor outer duct incorporates a pin in the front flange 9 o'clock location and a hole in the rear flange approximate 6 o'clock location to ensure correct positioning.

B. Fan Discharge Rear Compressor Section Outer Duct

(1) Between flanges G and H, and secured to the rear outer flange of the compressor intermediate fan case, is the fan discharge rear compressor section outer duct, cylindrical in shape and of aluminum construction. This duct mates at the rear to the front flange of the fan discharge diffuser section outer duct. Holes at the bottom of the front and rear flanges match the pins in the adjacent cases.

(2) Both upper quadrants of this duct have a large three hole bleed boss 45 degrees above the horizontal centerline. Each of these two bosses has two round holes toward the front for low pressure bleed air and an elongated hole toward the rear for anti-icing and eighth stage bleed air. The bosses incorporate replaceable helical coil inserts.

C. Diffuser Outer Fan Duct

(1) From flange H to J is the fan discharge diffuser section outer duct, cast of aluminum alloy. It has two oval-shaped high pressure bleed pad bosses, one between 10 and 11 o'clock and another between the one and two o'clock positions. There are two round bosses at the five and seven o'clock positions with openings for the fuel manifolds. Three studs at the seven o'clock position accommodate the fuel pressurizing and dump valve and four studs just below the four o'clock point are used for mounting the pressure ratio bleed control. Three bosses at the eight o'clock location accommodate, from front to rear, elbows for the breather, oil

pressure, and oil scavenge tubes to the No. 4 bearing area.

(2) The duct is equipped with anti-rotation positioning pins at the six o'clock location on the front flange and nine o'clock location on the rear flange.

D. Diffuser Inner Fan Duct

(1) Two semicircular aluminum duct segments, one left and one right, are positioned around the diffuser case. These diffuser inner fan duct segments form the inner wall of the annular duct at this location. Holes and cutouts in each segment accommodate the tubing running from the outer duct to the diffuser case.

(2) The duct segments are joined together by screws and anchored locknuts. They are held at the front flange of the diffuser case by screws secured to two semicircular removable gang nut assemblies. These gang nuts are held, in turn, by the diffuser case front flange bolts. The duct segments in certain engines are held at the rear by a metal strap arrangement featuring overlapping ends and attached by screws.

E. Combustion Chamber and Turbine Fan Duct Assembly (Combustion Section Fan Duct)

(1) Between flanges J and K is the combustion section fan duct assembly composed of upper and lower ducts, each in the shape of a half cylinder. Both halves are aluminum and are joined together along the sides of the engine by bolted flanges. The upper and lower ducts together form a single matched set. Holes at nine o'clock on the front and rear flanges match positioning pins in the mating cases.

(2) The lower duct has a combustion chamber outer drain boss riveted in place at the bottom midway between the front and the rear flanges. Certain JT8D-1,-1A, and -1B engines have an additional drain boss located on the bottom forward part of the intermediate flange. An intermediate flange, designated J1, supports the ignition exciter rear brackets. Two large fan airbleed openings equipped with studs are at the rear, just below the engine centerline, one on each side. A smaller boss on the lower right hand side near the front, may be utilized to provide fan air for cooling an airframe AC generator.

(3) Two igniter plug bosses are riveted to the wall of the lower duct at the four and eight o'clock positions near the front. A streamlined right igniter cable fairing is riveted inside at the four o'clock position. The left igniter cable fairing is not secured to the duct but is bolted to the rear of the No. 4 bearing tubes fairing. Both igniter cable fairings are fiberglass.

(4) The upper duct, like the lower, has flanges on both the sides and the ends.

F. Fan Turbine Inner Duct

(1) Two identical aluminum duct halves form the fan turbine inner duct, positioned around the turbine nozzle section of the basic inner engine. Each half is semi-circular and has locknuts riveted along one side flange. Screws secure the halves together.

(2) Two semi-circular gang nut assemblies are secured to the rear face of the combustion chamber case rear flange. They have an ell-shaped cross section and riveted anchor nuts to which the inner duct is held at the front by screws. At the rear, the inner duct fits closely over the fan discharge turbine exhaust inner duct front flange.

G. Fan Discharge Turbine Exhaust Section Outer Duct

(1) Positioned outside the turbine exhaust outer case at the rear of the engine, from flange K to M, is the fan discharge turbine exhaust section outer duct assembly, constructed of steel. The engine rear mount ring, which has holes for ground handling provisions, is an integral welded part of this duct.

(2) One Pt7 tube boss is located to the left of the six o'clock position behind the mount ring flanges. Eight streamlined struts in the ID secure this duct to the turbine exhaust outer case. An anti-rotation type positioning pin located in the front flange at the nine o'clock point.

H. Fan Discharge Turbine Exhaust Inner Ducts

FAN DISCHARGE DUCTS AND CASES - DESCRIPTION-00

(1) Positioned around the front portion of the turbine exhaust case is the fan discharge turbine exhaust inner front duct. This aluminum duct, shaped like a circular band, has screw holes through the front flanges and cut-outs in the rear flange. It is held by screws to a two piece gang nut assembly on the front face of the rear flange of the turbine outer rear case.

(2) Around the rear of the turbine exhaust case is the fan discharge turbine exhaust inner rear duct. The outer surface of this circular aluminum duct decreases in diameter from front to rear then flares forward to form a smoothly rounded trailing edge. The duct fits closely inside the front duct rear edge and is secured to the rear flange of the exhaust case by bolts. Cutouts in the duct accommodate the engine tubing.

FAN DISCHARGE FRONT COMPRESSOR OUTER DUCT - REPAIR-00

Task 72-71-01-300-001:

R 1. Front Compressor Outer Duct Crack And Indentation Repair
R (Deleted)

R NOTE: This repair is relocated to Task 72-34-07-300-001,
R (72-34-07, Repair-00).

REAR COMPRESSOR DUCT CRACK AND INDENTATION REPAIR - REPAIR-00

Task 72-71-02-300-001:

R 1. Rear Compressor Outer Duct Crack And Indentation Repair
R (Deleted)

R NOTE: This repair is relocated to Task 72-34-08-300-001,
R (Section 72-34-08, Repair-00) and Task 72-71-03-300-001,
R (Section 72-71-03, Repair-00).

R COMBUSTION CHAMBER AND TURBINE FAN DUCT - REPAIR-00

R Task 72-71-03-300-001:

R 1. Duct Crack And Indentation Repair

R A. Blend Repair

R NOTE: This repair is for dents 0.015 inch deep maximum.

R (1) Blend repair the damaged area by SPOP 533. Refer to
R Standard Practices, Task 70-00-00-380-002, Section
R 70-00-00, (Repair-02).

R (2) Do a fluorescent pentrant inspection of the blended
R area by SPOP 70, normal sensitivity. Refer to Standard
R Practices, Task 70-00-00-230-001, Section 70-00-00,
R (Inspection/Check-01).

R (3) Do an anodize touch-up of bare surfaces by SPOP 42.
R Refer to Standard Practices, Task 70-00-00-380-010,
R Section 70-00-00, (Repair-10).

R NOTE: Do a patch repair on duct walls that show sharp
R dents which break or crack the duct wall or have
R an indentation with corners less than 0.062 inch
R radius or indentations that are more than 0.015
R inch deep.

R B. Crack Repair (Cracks 5 Inches Long Maximum)
R See Figure 801.

R (1) Repair cracks five inches long maximum by one of the
R methods shown:

R (a) Stop Drill Procedure

R 1 Stop drill crackS five inches long maximum in
R the outer duct with a 0.1875 inch diameter
R drill. Drill a hole at each end of the crack.

R 2 Do a periodic inspection at 100 cycle
R intervals.

R (b) Patch Repair

R NOTE: Before a patch is installed, make sure the
R patch will not cause a blockage of engine
R or aircraft external hardware.

R COMBUSTION CHAMBER AND TURBINE FAN DUCT - REPAIR-00

R 1. Cut out the damaged area in the duct with a
R circle five inches diameter maximum. The
R circle must remove all of the crack or
R indentation.

R 2. Make patches of 6061 T6 aluminum alloy 0.062
R inch thick, and cut the patch to shape as shown
R in the figure.

R 3. Bend the patch to have as good a fit as
R possible with the contour of the duct. Attach
R the patch tightly in position on the duct.

R 4. Transfer drill rivet holes for rivets,
R reference Cherry rivet PN CR-2249-4-3 or
R equivalent.

R NOTE: Rivet length and quantities will be
R different at each patch location, but
R rivets must not be more than one and
R one-half inches apart.

R 5. Remove the patch and remove all burrs from the
R holes.

R 6. Clean the bond surfaces by SPOP 208, local
R wipe method. Refer to Standard Practices,
R Task 70-00-00-100-004, Section 70-00-00.
R (Cleaning-04).

R 7. Apply PWA 36003-2 sealant or PWA 457 epoxy
R resin to the inner surface of the patch
R as shown approximately 0.015 - 0.040 inch
R thick. Refer to Standard Practices,
R Task 70-00-00-400-003, Section 70-00-00.
R (Rem/Inst-03).

R 8. Put the patch in position on the duct and apply
R some standard sheet metal fasteners to attach
R the parts together for initial riveting.
R Install and compress sufficient rivets to hold
R the patch in position.

R 9. Remove the sheet metal fasteners. Install and
R compress the remaining rivets. Examine the
R rivets to make sure that they are tight.

R 10. Cure the PWA 36003-2 or PWA 457 epoxy resin.

R 11. Do an anodize touch-up of bare surfaces by SPOP 42. Refer to Standard Practices, Task 70-00-00-380-010, Section 70-00-00, (Repair-10).

R 12. Record in the engine log that inspection of the patch repair is necessary at the subsequent shop visit to make sure that the rivets are tight and that cracks did not extend.

R C. Crack Patch Repair (Cracks 10 Inches Long Maximum)
R See Figure 802.

R NOTE: Use a patch repair on a duct that shows sharp dents which break or crack the duct wall or have an indentation with corners less than 0.062 inch radius or indentations that are deeper than 0.015 inch. There is no limit to the number of large patches or small plates used, but the total number of patches must not be more than ten for each duct.

R NOTE: This is applicable to circumferential cracks ten inches long maximum and to all axial cracks (no length limit), except those that end five inches or less from the case flange.

R NOTE: Before a patch is installed, make sure that the patch will not cause a blockage of engine or aircraft external hardware.

R (1) Stop drill the crack ends with a 0.1875 inch diameter drill.

R (2) Use an AMS 4037 patch that is 0.059 - 0.065 inch thick. Cut the patch as shown in the figure.

R (3) Drill rivet holes in the patch for the rivets, reference Cherry rivet PN CR-2249-4-3 or equivalent. Remove all burrs from the holes.

R (4) Bend the patch to have as good a fit as possible with the contour of the duct. Attach the patch tightly in position on duct.

R COMBUSTION CHAMBER AND TURBINE FAN DUCT - REPAIR-00

R (5) Transfer drill rivet holes to the duct. Remove the
R patch and remove all burrs from the holes.

R NOTE: The number of rivets necessary and the size of
R the patches will increase or decrease with the
R length of the crack. See Figure 802 for the
R rivet pattern requirements.

R (6) Clean the bond surfaces by SPOP 208, local wipe method.
R Refer to Standard Practices, Task 70-00-00-100-004,
R Section 70-00-00. (Cleaning-04).

R (7) Apply PWA 36003-2 sealant or PWA 457 epoxy resin to
R the inner surface of the patch as shown approximately
R 0.015 - 0.040 inch thick. Refer to Standard
R Practices, Task 70-00-00-400-003, Section 70-00-00.
R (Removal/Installation-03).

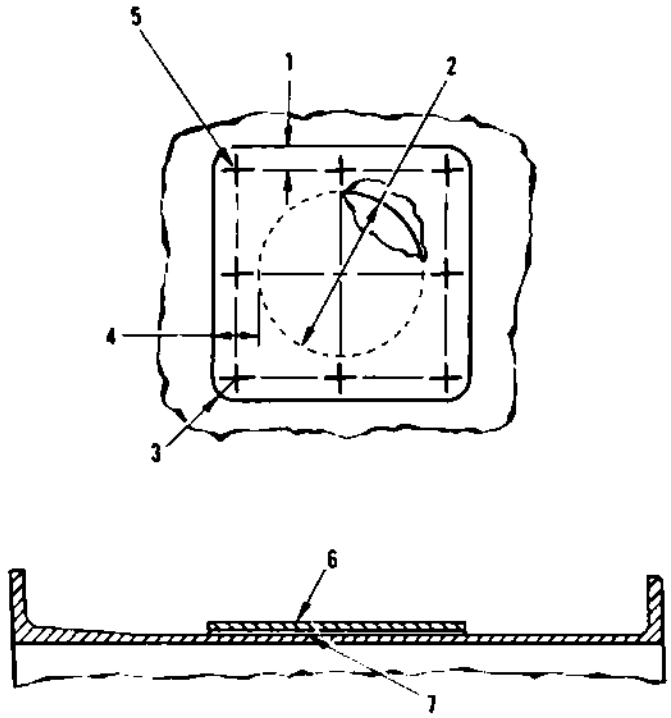
R (8) Put the patch in position on the duct and apply some
R standard sheet metal fasteners to attach the parts
R together for initial riveting. Install and compress
R sufficient rivets to hold the patch in position.

R (9) Remove the sheet metal fasteners. Install and compress
R the remaining rivets. Examine the rivets to make sure
R that they are tight.

R (10) Cure the PWA 36003-2 sealant.

R (11) Do an anodize touch-up of bare surfaces by SPOP 42.
R See Standard Practices, Task 70-00-00-380-010, Section
R 70-00-00, (Repair-10).

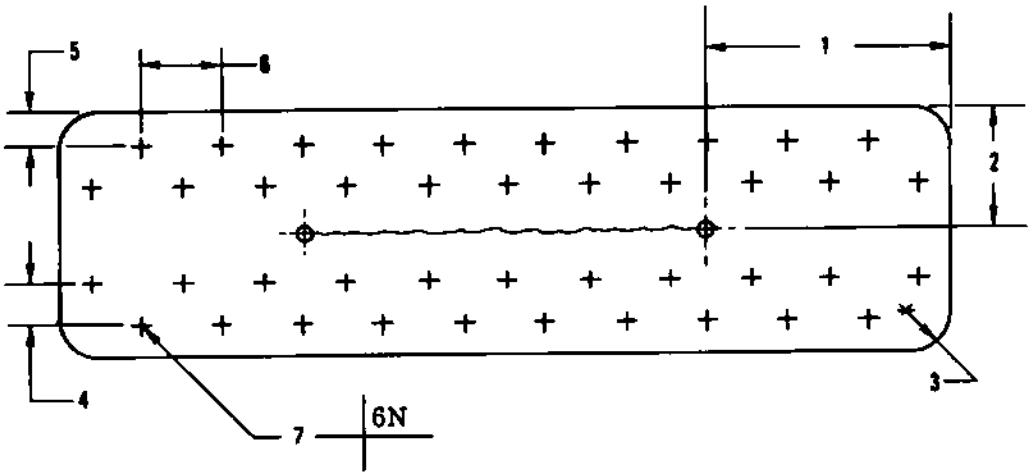
R COMBUSTION CHAMBER AND TURBINE FAN DUCT - REPAIR-00



L-H6744 (0204)

R 1. 0.280 Inch. Four Places
R 2. 5.000 Inch Diameter Maximum Hole To Repair Cracks Or
R Indentations.
R 3. 0.250 - 0.281 Inch Radius. Chamfer 0.100 - 0.120 Inch X 45°
R Four Places
R 4. 0.560 Inch Minimum. Machine Index 6 Patch To This Dimension
R To Get Smallest Possible Patch.
R 5. Rivet Eight Places For Each Patch Maximum; Four Places For Each
R Patch Minimum. 40 Places Maximum Where Necessary.
R 6. Reference Patch
R 7. Apply Adhesive Five Places Maximum Where Necessary.

R Duct Patch Repair (Cracks
R 5 Inches Maximum)
R Figure 801
R (Task 72-71-03-300-001)



L-H6745 (0204)

R 1. 3.000 Inches ± 0.062, Two Sides
R 2. 1.500 Inches ± 0.062, Two Sides
R 3. 1.000 Inch Radius ± 0.062, Four Places
R 4. 0.500 Inch Maximum
R 5. 0.400 Inch Minimum
R 6. 0.560 Inch Minimum; 1.100 Inch Maximum
R 7. Cherry Rivet PN CR3223-6-3 Or Equivalent

R Duct Patch Repair (Cracks
R 10 Inches Maximum)
R Figure 802
R (Task 72-71-03-300-001)

FAN DISCHARGE AIR BLEED MANIFOLDS AND SLEEVES - DESCRIPTION-00

Task 72-71-10-990-001:

1. Fan Discharge Air Bleed Manifolds And Sleeves

A. Rear Compressor Air Bleed Manifolds and Tubes
See Figure 1.

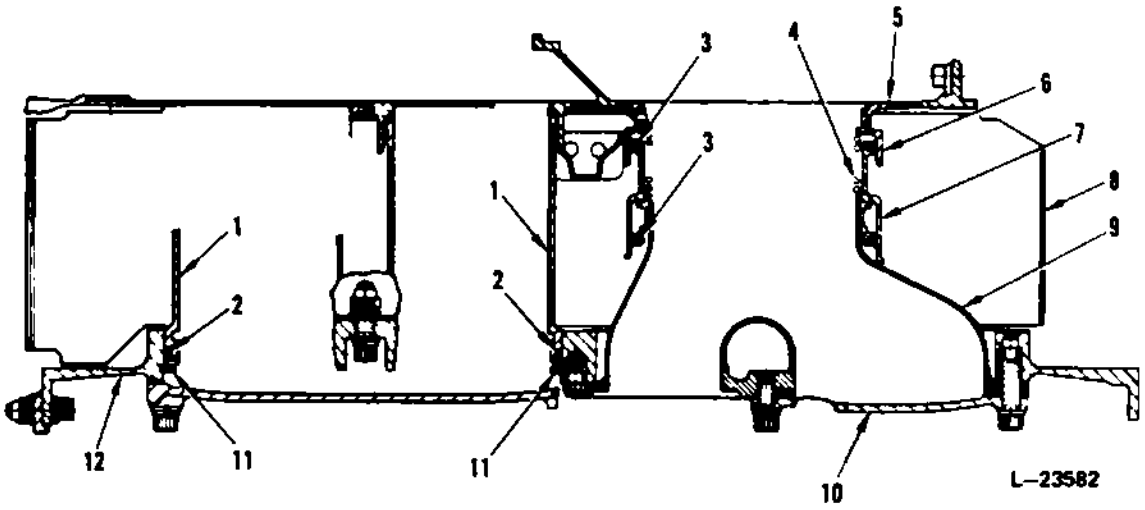
(1) Bolted into the fan discharge rear compressor section outer duct are two "Y"- type air bleed manifolds, one on each side 45 degrees above the horizontal centerline. Each manifold has a single opening at the inner end which receives eighth stage air. Liners and sleeves plated on the inner sealing surfaces and metal seal rings accommodate the expansion and contraction of the engine. The manifold divides into two openings at the outer end, the forward opening for engine anti-icing air and the larger rear opening for the eighth stage bleed air pad.

(2) In front of each air manifold, two straight transfer tubes conduct low pressure air from the sixth stage to the double-hole low pressure bleed pads. When blanked off, an oval-shaped gasket and cover is used over each double-hole pad.

B. Diffuser Section Air Bleed Manifolds
See Figure 2.

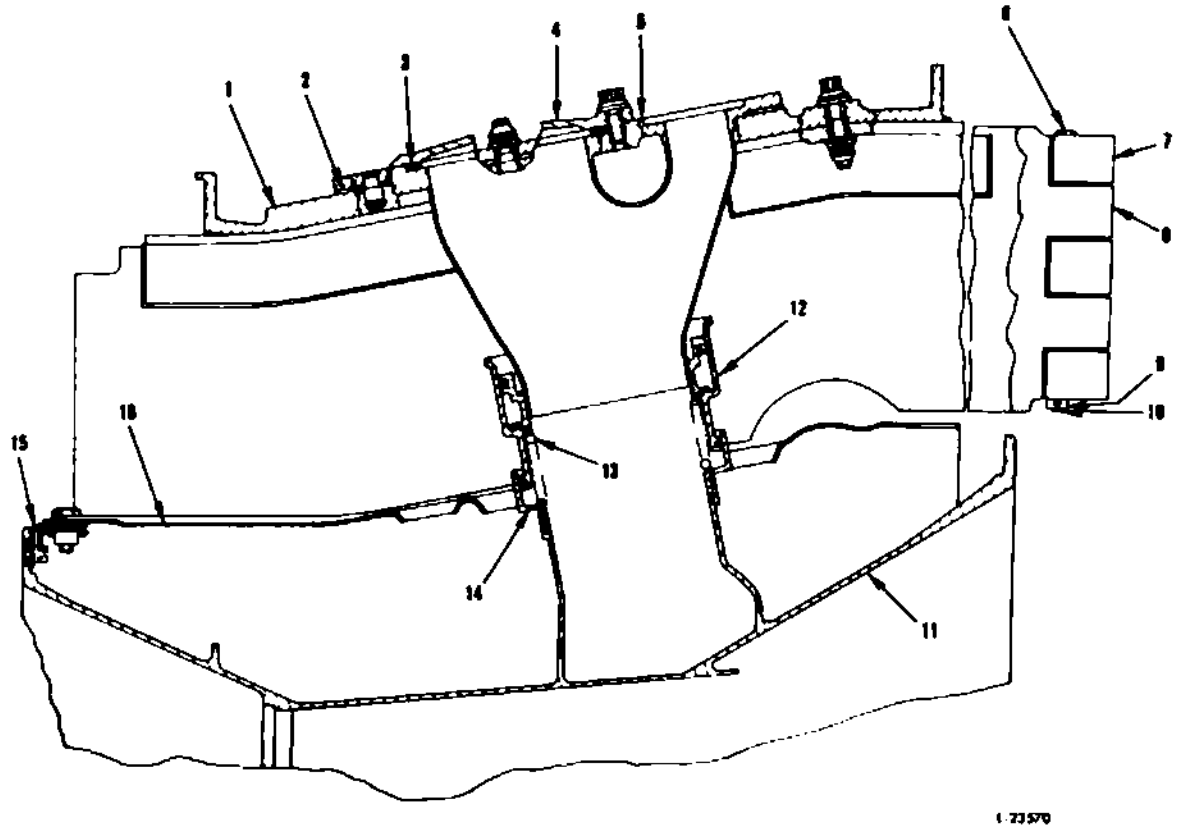
(1) Bolted into the diffuser section outer duct, one between the ten and eleven o'clock position and another between the one and two o'clock position, are two similar diffuser air supply manifolds. Each steel manifold has a single opening with a ring groove at the inner end to fit into the diffuser case and divides into two openings at its outer boss. Liners and sleeves plated on the inner sealing surfaces and metal seal rings accommodate the expansion and contraction of the engine. High pressure bleed air is carried directly from the diffuser case to outside the diffuser section outer duct through these left and right manifolds.

FAN DISCHARGE AIR BLEED MANIFOLDS AND SLEEVES - DESCRIPTION-00



1. Bleed Air Transfer Tube, 2 Required at Each Side of Engine.
2. Seal Ring, 2 to Each Transfer Tube
3. Seal Ring, One Each for Bleed Manifolds and Liners.
4. Coil Spring
5. Rear Compressor Inner Fan Duct
6. Expansion Joint Sleeve (Riveted to Inner Fan Duct)
7. Expansion Joint Liner
8. Front Fairing
9. Bleed Manifold, One at Each Side of Engine
10. Bleed Manifold Cover
11. Transfer Tube Retaining Ring, One to Each Tube
12. Rear Compressor Outer Fan Duct (Between Flanges G and H)

Diffuser Section
Air Bleed Manifold
Figure 1
(Task 72-71-10-990-001)



1. Diffuser Outer Fan Duct
2. Boss Gasket
3. Cover Gasket
4. Cover
5. Manifold Outer Boss
6. Fairing Pin
7. Right Rear Fairing Segment
8. Left Rear Fairing Segment
9. Fairing Pin Washer
10. Cotterpin
11. Diffuser Case
12. Liner (With Seal Ring at Inner End)
13. Spring
14. Sleeve
15. Diffuser Inner Fan Duct Mounting Flange
16. Diffuser Inner Fan Duct

Diffuser Section
Air Bleed Manifold
Figure 2
(Task 72-71-10-990-001)

Task 72-71-20-990-001:

1. Fan Discharge Fairings

A. Rear Compressor Section Fan Duct Fairings

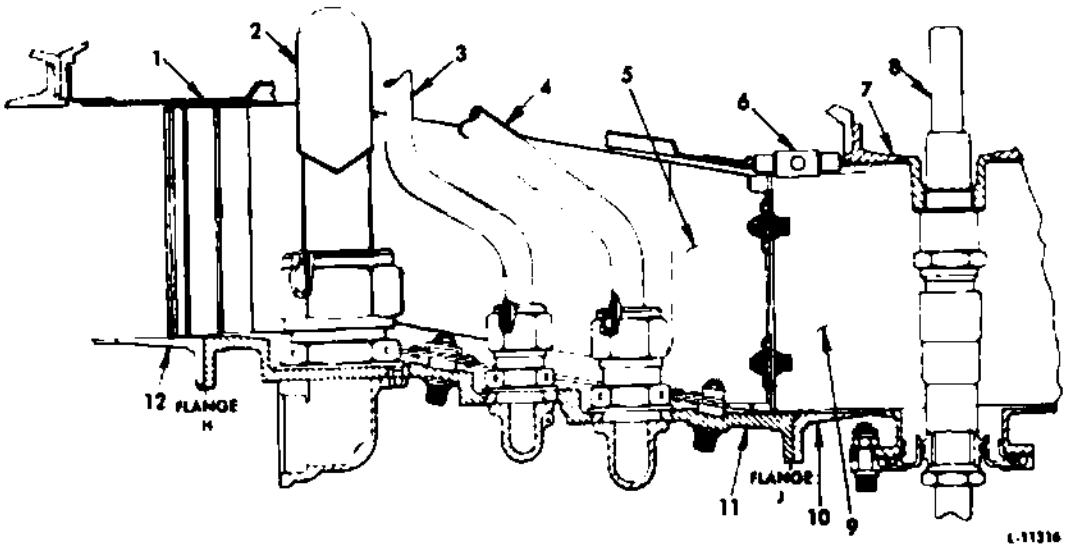
(1) In the fan discharge air path behind the fan discharge intermediate case two fiberglass fairings are bolted in place, each positioned 45 degrees above the horizontal centerline. These fairings streamline the flow of air around the air bleed manifolds between the rear compressor section and diffuser section inner and outer ducts. Each fairing has a full front segment and two rear segments.

B. No. 4 Bearing Tubes Fairing

(1) The No. 4 bearing tubes fairing, a streamlined aluminum (formerly fiberglass) two-piece unit, is bolted in place at the eight o'clock position in the fan air stream between the diffuser case and diffuser section outer duct. It streamlines the flow of air around the No. 4 bearing pressure, scavenge, and breather tubes located within it. See Figure 1.

NOTE: Engine operation without rear compressor fan duct fairings or No. 4 bearing tubes fairing in place is acceptable. However, such operation can result in slight loss of performance due to non-streamlined airflow around exposed tubes. Fairings should be replaced the next time fan discharge area becomes accessible.

FAN DISCHARGE FAIRINGS - DESCRIPTION-00



1. Diffuser Inner Duct
2. No. 4 Bearing Breather Manifold
3. Oil Pressure Line
4. Oil Scavenge Line
5. No. 4 Bearing Tubes Fairing
6. Diffuser Fan Duct Strap
7. Combustion Chamber Outer Case
8. Igniter Plug
9. Left Igniter Plug Cable Fairing
10. Combustion Section Fan Duct
11. Diffuser Section Outer Duct
12. Rear Compressor Outer Fan Duct

Section at No. 4
Bearings Tubes Fairing
Figure 1
(Task 72-71-20-990-001)

73-00-00

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73−00−00	ENGINE FUEL AND CONTROL − TROUBLESHOOTING−00 • 73−00−00−810−001: General See Chapter/Section 72−00−00, Troubleshooting−01 For Fault Isolation Procedures On Fuel System.
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73−21−02	FUEL CONTROL (JFC60−2/−3) − REMOVAL/INSTALLATION−00 • 73−21−02−450−001: Removal/Installation of Fuel Control (Engines Having Sensorless Pressure Regulating Valve) • 73−21−02−450−002: Removal/Installation of the Fuel Control Main Filter Group • 73−21−02−990−001: Tools
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ENGINE FUEL AND CONTROL - DESCRIPTION-00

Task 73-00-00-990-001:

1. General

See Figure 1.

A. The engine fuel distribution and control system of the JT8D engine consists basically of an engine driven fuel pump and fuel control, an optional fuel de-icing system, a fuel pressurizing and dump valve, and a split fuel manifold, delivering fuel to nine individual fuel nozzles.

Task 73-00-00-990-002:

2. Engine Fuel Distribution System

A. Fuel Pump

(1) Fuel is supplied from the tanks through the necessary strainers and valves to the engine driven fuel pump which is supplied with the engine. From here it is pumped to the fuel control where it is metered in the proper quantities. Excess fuel is returned to the pump. A fuel filter is integral with the pump.

B. Fuel De-Icing System

(1) The optional fuel de-icing system is located between the boost and main stages of the engine-driven fuel pump and consists primarily of an air-fuel heater, air shutoff valve, differential fluid pressure switch, and the necessary tubing.

(2) The differential fluid pressure switch provides a means of indicating icing conditions or a clogged filter.

(3) The fuel de-icing system functions to prevent the restriction, or even stoppage, of fuel flow caused by the formation of ice within any of the components of the fuel system through which fuel may subsequently pass. Refer to Chapter 73-14-00 for additional descriptive information on the Fuel De-Icing System.

C. Fuel Pressurizing and Dump Valve

(1) From the fuel control, the fuel flows through the fuel flowmeter and the fuel coolant oil cooler to the pressurizing and dump valve. The pressurizing valve schedules flow to the secondary fuel nozzles as a function of pressure drop across the primary nozzles. The dump valve is a two-position valve which is hydraulically operated by primary fuel pressure during engine operation. At shutdown the dump valve opens and allows fuel in the manifold to drain.

D. Fuel Manifolds and Fuel Nozzle and Support Assemblies

(1) The divided fuel flow from the fuel pressurizing valve is delivered through the annular duct to the dual-tube fuel manifolds mounted on the diffuser case. The fuel then enters the nine fuel nozzle and support assemblies. The nozzle support flange of each assembly is bolted to the diffuser case, and the support positions the nozzle in the combustion chamber.

Task 73-00-00-990-003:

3. Engine Fuel Controlling System

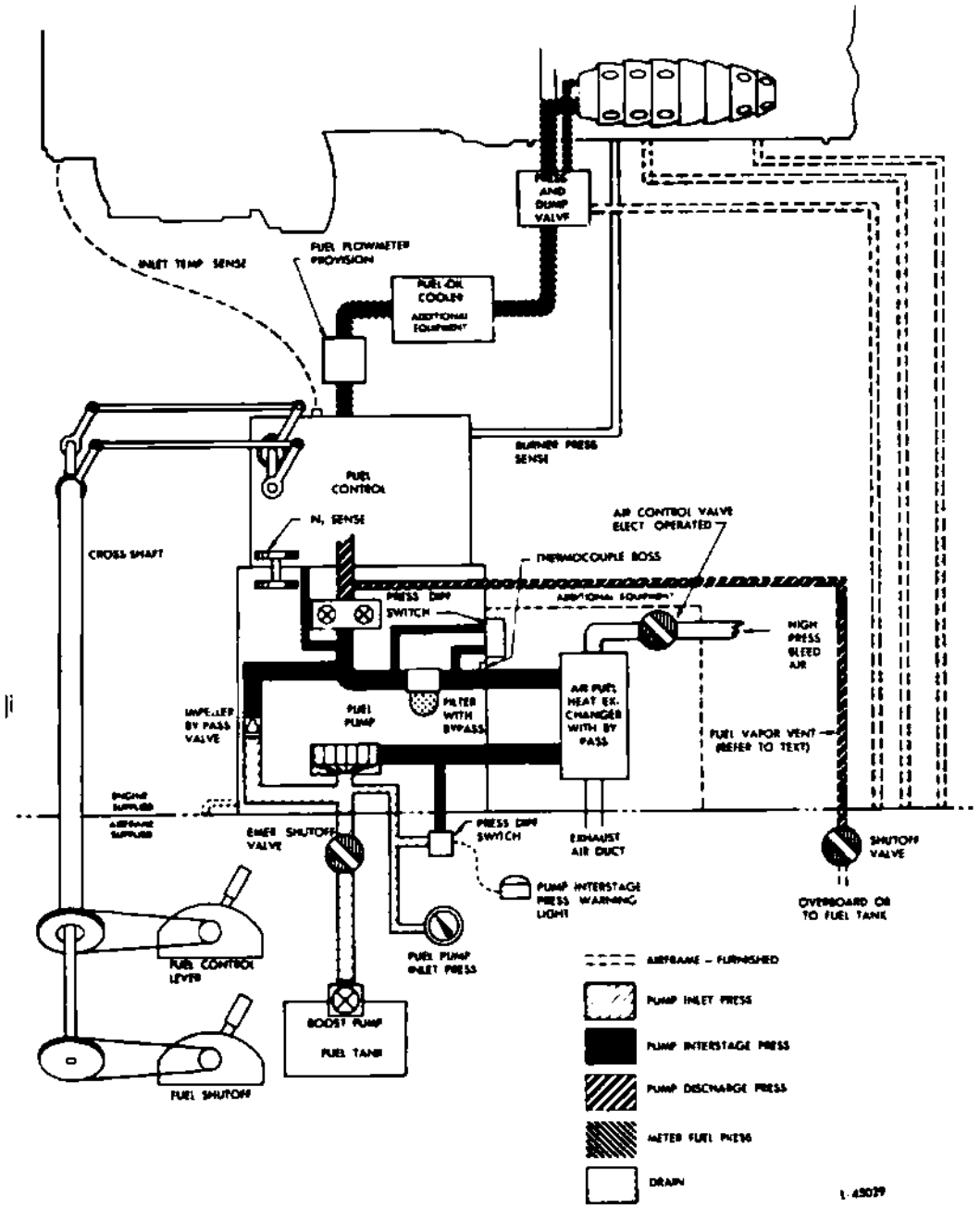
A. Fuel Control

(1) The fuel control is provided with two control levers; one to control the engine speed during all forward and reverse thrust operations, and the other to control engine starting and shutdown, by operating the fuel shutoff lever-operated pilot valve and thus the manifold drain valve in proper sequence. The fuel control accurately governs the steady state selected speed, acceleration and deceleration, and it indirectly governs the maximum turbine temperature of the engine during both forward and reverse thrust operation.

Task 73-00-00-990-004:

4. Engine Fuel Indicating Systems

A. Information on the airframe-mounted engine fuel indicating systems will be found in Chapter 73-30-00 of the airframe manufacturer's Maintenance Manual.



Engine Fuel System Schematic
Figure 1
(Task 73-00-00-990-004)

Task 73-00-00-810-001:

1. General See Chapter/Section 72-00-00, Troubleshooting-01 For Fault Isolation Procedures On Fuel System.

Task 73-00-00-210-001:

1. Fuel Nozzle And Support Assemblies - Inspection

A. Basic Hot Section Inspection Requirements (see Chapter/Section 72-40-00, Inspection/Check).

(1) Inspect fuel nozzles and supports for loose heat shield, fuel nozzle orifices for coke buildup, evidence of burning of fuel nozzle nut, and excessive wear in burner can mating area.

NOTE: Fuel nozzle orifices can be cleaned, as required, per Chapter/Section 72-00-00, Engine - Cleaning.

B. Fuel Nozzle Limits And Procedures

(1) Examine the rear face of fuel nozzles for burning, erosion, and cracking.

NOTE: This inspection is accomplished using a borescope put through the igniter ports in the combustion chambers, as described in Chapter/Section 72-00, Inspection/Check, Paragraph 13.

(a) Fuel nozzles before the low emission configuration (Reference SB 5650). See Figure 201.

1 Fuel nozzles with burning, erosion, or cracking in Area A (see Figure 201) can continue in service for a maximum of 10 hours, if there is no sign that the heat shield is detaching from the fuel nozzle. The fuel nozzle must be removed before the next flight if the heat shield is partially or fully detached from the fuel nozzle.

2 Fuel nozzles with burning, erosion, or cracking in Areas B or C (see Figure 201) can continue in service for a maximum of 50 hours if the condition of the combustion chambers and 1st stage turbine vanes is in limits.

(b) Fuel nozzles of low emissions configuration (Reference SB 5650). See Figure 202.

1. Examine the rear face of fuel nozzles and fuel nozzle nuts for signs of burning and cracking. Fuel nozzles with damage that is more than the limits defined in Table 201 can be continued in service for a maximum of 50 hours, if the combustion chambers and 1st stage turbine vanes are in limits.

CONDITION	LIMITS
(1) Cracks across fuel nozzle nut lip face up to air cooling holes. See Figure 202.	(a) Maximum of one radial crack across lip face to each lip cooling hole. See Area A. (b) No circumferential cracks between cooling holes. See Area B.
(2) Cracks of fuel nozzle nut deflector. See Figure 202.	(a) Maximum of one crack between any one key hole slot and any one deflector air cooling hole (8 cracks maximum). See Areas C, D and E. (b) Maximum of one radial crack in deflector between each key hole slot (eight cracks maximum). See Areas D and E. (c) No circumferential cracks in deflector between key hole slots. See Areas D and E.
(3) Erosion of nozzle nut lip face and lip OD. See Figure 202.	(a) Depth of eroded area must not exceed bottoms of lip cooling holes. See Area A. Total arc of eroded area must not exceed 180 degrees. If arc of eroded area is 90 - 180 degrees, the engine should be scheduled for repetitive borescope inspection of 1st stage turbine vanes, combustion chambers, and fuel nozzles. Use

Fuel Nozzle Rear Face Inspection (Fuel Nozzles Of Low Emission Configuration) Table 201

CONDITION		LIMITS	
(CONTINUED)			
			intervals of approximately 750 hours or 600 cycles, whichever comes first.
(4)	Erosion of nozzle nut deflector keyhole slots and deflector ID. See Figure 202.	(a)	Slot width can be increased by erosion to maximum of 0.08 inch (2.023 mm). New, uneroded slot has width of 0.025 inch (0.625 mm). See Areas D and E.
(5)	Burning, erosion, or cracking of nut inner lip. See Figure 202.	(a)	Not acceptable. See Area F.
(6)	Burning, erosion, or cracking of fuel nozzle. See Figure 202.	(a)	Not acceptable. See Areas G, H, and I.

Fuel Nozzle Rear Face
Inspection (Fuel Nozzles Of
Low Emission Configuration)
Table 201 (Continued)

(2) Examine the fuel nozzle and support assemblies for penetration of the air scoop into the support fairing (or heat shield), and examine the fairings for cracks, broken welds, or burning.

NOTE: This inspection is done with a borescope inserted through the igniter ports in the outer combustion chamber case, but before it is inserted into the combustion chamber, point it forward to see the fuel nozzle supports. Move the borescope to see all the fuel nozzle positions.

NOTE: This inspection only applies to fuel nozzles of the Low Emission configuration. Refer to SB 5650.

(a) Examine fuel nozzle and support assemblies for penetration of the air scoop into the support fairing, using one of the three procedures listed below. See Figure 203 (Sheets 1 and 2), Figure 204, and Figure 205.

NOTE: This inspection is not necessary for fuel nozzle and support assemblies that have incorporated SB 6405.

1 Examine air scoop and support fairing to determine if the corner radius of the air scoop is visible, as shown in Figure 203 (Sheets 1 and 2). Remove or reinspect the fuel nozzle and support assemblies as necessary. See Table 202.

INSPECTION RESULTS	NECESSARY ACTION
(1) Corner radius of the air scoop is NOT contacting the fuel nozzle support fairing See Figure 203, Sheet 1.	(a) Reinspect at next convenient maintenance interval.
(2) Corner radius of the air scoop IS contacting the fairing, but the radius is still visible.	(a) Reinspect in 500 hours or use Table 203 or Table 204 for evaluation.
(3) Corner radius of the air scoop is worn completely in the fairing, and the radius is NOT visible See Figure 203, Sheet 2.	(a) Remove in 50 hours or use Table 203 or Table 204 for evaluation.

Air Scoop Penetration Inspection
Based On Observation Of
Air Scoop Corner Radius
Table 202

2 Examine the air scoop to measure the actual depth of penetration of the air scoop in the support fairing, as shown in Figure 204. Remove or reinspect the fuel nozzle and support assemblies as necessary. See Table 203.

NOTE: To use this procedure, you must make the necessary on-wing measurements to a precision of ± 0.020 inch (0.508 mm).

INSPECTION RESULTS	NECESSARY ACTION
(1) Corner radius of the air scoop is NOT contacting the fuel nozzle support fairing. See Figure 203, Sheet 1.	(a) Do the inspection again at the next convenient maintenance interval.
(2) Measured depth of air scoop penetration is less than 0.140 inch (3.556 mm). See Figure 204.	(a) Do the inspection again in 500 hours or less.
(3) Measured depth of air scoop penetration is less than 0.160 inch (4.064 mm). See Figure 204.	(a) Do the inspection again in 250 hours or less.
(4) Measured depth of air scoop penetration is less than 0.180 inch (4.572 mm). See Figure 204.	(a) Do the inspection again in 100 hours or less.
(5) Measured depth of air scoop penetration is 0.180 inch (4.572 mm) or more. See Figure 204.	(a) Remove the nozzle in 50 hours or less.

Air Scoop Penetration Inspection
Based On Measured Depth
Of Air Scoop Penetration
Table 203

3 Examine the air scoop and support fairing to measure the gap between the air scoop and the fairing on the side of the nozzle opposite to the contact between the air scoop and the fairing, as shown in Figure 205. Remove or reinspect fuel nozzle and support assemblies as necessary. See Table 204.

NOTE: To use this procedure, you must make the necessary on-wing measurements to a precision of ± 0.020 inch (0.508 mm).

	INSPECTION RESULTS		NECESSARY ACTION
(1)	Corner radius of the air scoop is NOT contacting the fuel nozzle support fairing. See Figure 203, Sheet 1.	(a)	Do the inspection again at the next convenient maintenance interval.
(2)	Measured gap between air scoop and fairing, on side of nozzle opposite contact between scoop and fairing, is less than 0.220 inch (5.588 mm). See Figure 205.	(a)	Do the inspection again in 500 hours or less.
(3)	Measured gap between air scoop and fairing, on side of nozzle opposite contact between scoop and fairing, is less than 0.360 inch (9.144 mm). See Figure 205.	(a)	Do the inspection again in 250 hours or less.
(4)	Measured gap between air scoop and fairing, on side of nozzle opposite contact between scoop and fairing, is less than 0.470 inch (11.938 mm). See Figure 205.	(a)	Do the inspection again in 100 hours or less.
(5)	Measured gap between air scoop and fairing, on side of nozzle opposite contact between scoop and fairing, is 0.470 inch (11.938 mm) or more. See Figure 205.	(a)	Remove the nozzle in 50 hours or less.

Air Scoop Penetration Inspection
Based On Measured Gap Between
Air Scoop And Fairing On
Opposite Side Of Nozzle
Table 204

(b) Examine the fuel nozzle support fairings for evidence of burning or melting. See Figure 206. Fuel nozzles that exhibit burning or melting must be removed in 25 hours.

NOTE: This inspection is not necessary for fuel nozzle and support assemblies that have incorporated ASB A6169.

(c) Examine fuel nozzle support fairings for cracks and broken welds. See Figure 207.

1 Examine the support fairing for cracks along seam weld on aft (downstream) surface of the fairing. Examine the tack welds which attach fairing to support at forward (upstream) surface and at inboard surface for cracks. Cracks in or around the tabs, seam weld, or tack welds are acceptable for continued service as follows:

a Support fairings that have cracks at one or more of the weld locations can be continued in service with an inspection every 500 hours to look for fairing liberation or wear into the support.

b Support fairings that are detached and at an angle, but not liberated, can be continued in service with an inspection every 500 hours to look for fairing liberation or wear into the support.

c Support fairings that have a radial crack the entire length of forward edge of fairing must be removed from service in 25 hours.

2 If the fuel nozzle air scoop has contacted the fuel nozzle support fairing (see Figure 203 (Sheet 2), examine support fairing for cracks at the location of contact between the support fairing and air scoop.

a Support fairings that have cracks can be continued in service with an inspection every 150 hours. If the crack grew longer since the previous inspection, reduce the inspection interval to every 50 hours.

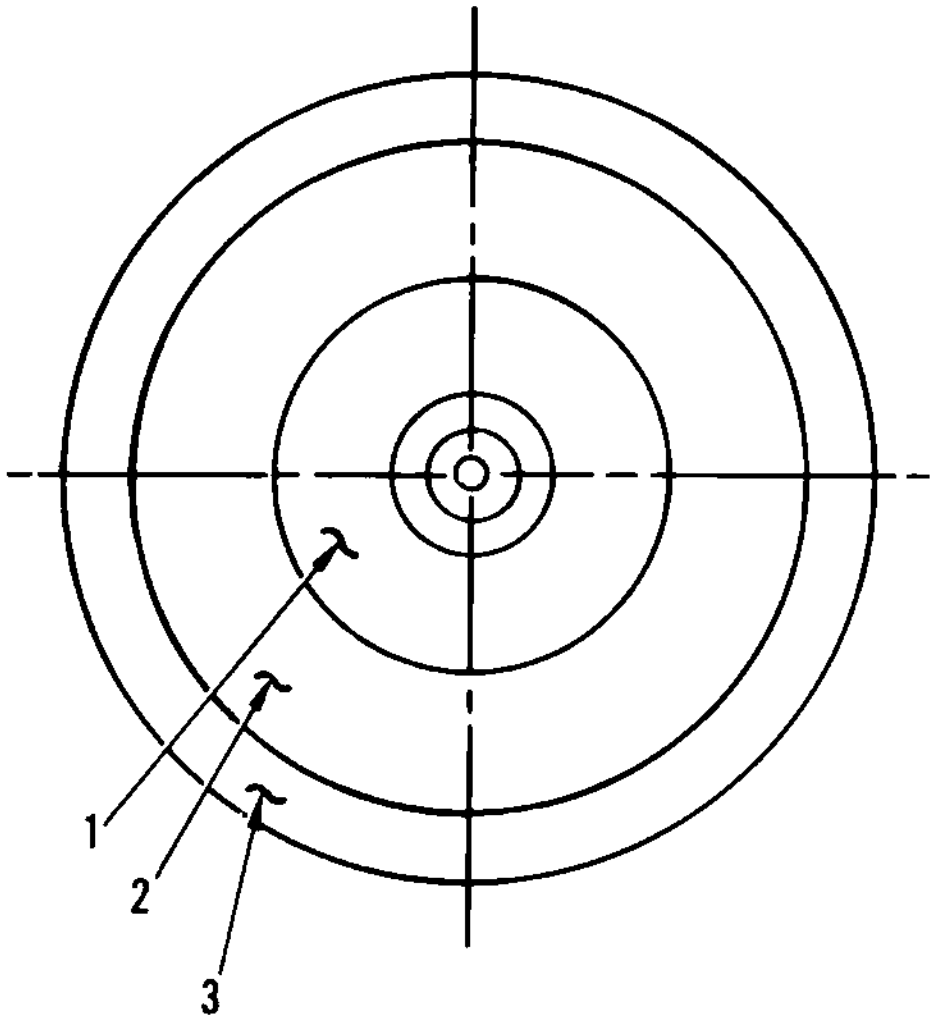
b Support fairings that have cracks which can cause a piece of fairing to break off must be removed from service in 25 hours.

3 If a fuel nozzle is detected with the support fairing missing, examine the combustion chamber and 2nd stage turbine vanes downstream of that nozzle (accounting for gas path swirl) for distress indicative of a "streaking" fuel nozzle.

a Reinspect the combustion chamber and 2nd stage turbine vanes at 500 hour intervals.

b Reduce this interval or remove the engine in accordance with applicable Maintenance Manual and/or Service Bulletin Limits for combustion and turbine distress.

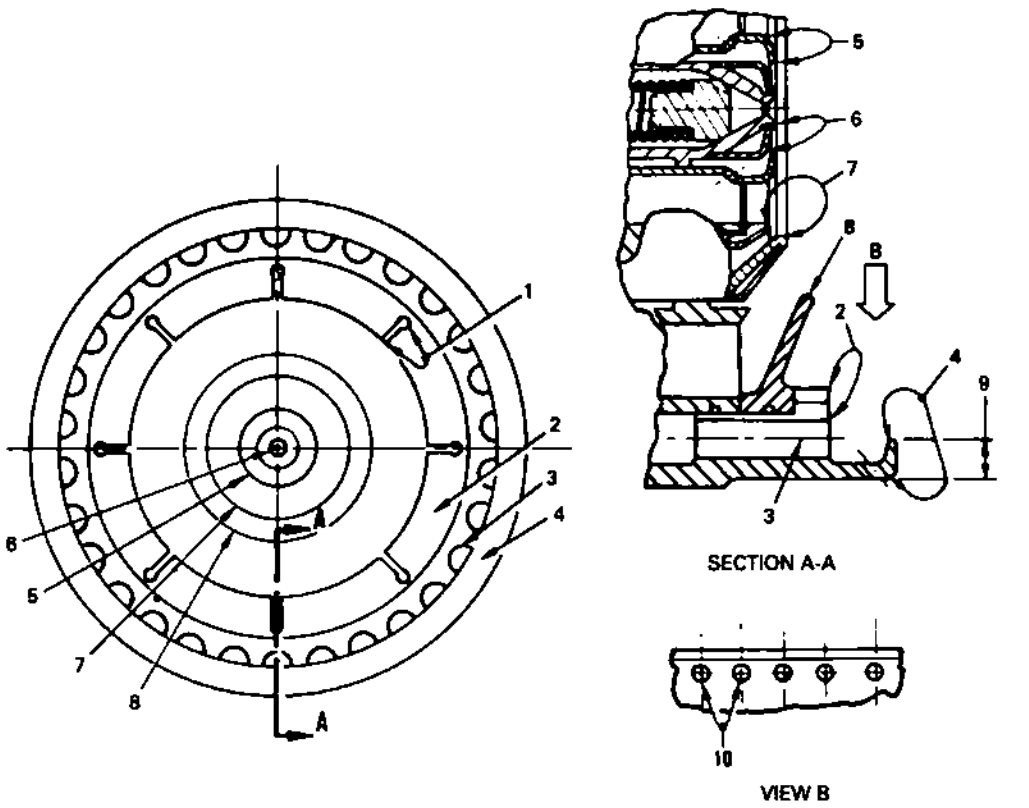
4 If a fuel nozzle is detected with the support fairing loose, but in place and wearing into support, contact Manager of Technical Support Group, Pratt & Whitney, 400 Main Street, East Hartford, CT 06108-0969 with a detailed description of the wear, including photos, if possible, for further recommendations.



L-86498

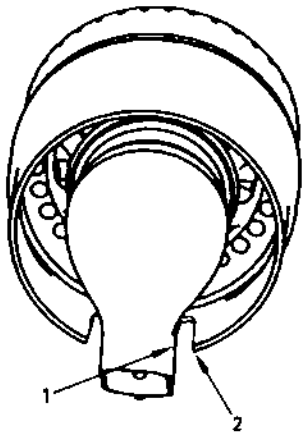
1. Area A (Fuel Nozzle Heat Shield)
2. Area B (Fuel Nozzle Nut Face)
3. Area C (Fuel Nozzle Nut Heat Shield)

Fuel Nozzle Assembly Inspection
(Prior To Low Emissions Type)
Figure 201
(Task 73-00-00-210-001)



1. Area D - Keyhole Slots (8)
2. Area E - Deflector
3. Area C - Deflector Cooling Air Holes (30)
4. Area A - Lip Face
5. Area H
6. Area G
7. Area I
8. Area F - Nut Inner Lip
9. 0.159 Inch (4.039 mm), Reference
10. Area B - Lip Cooling Holes (36)

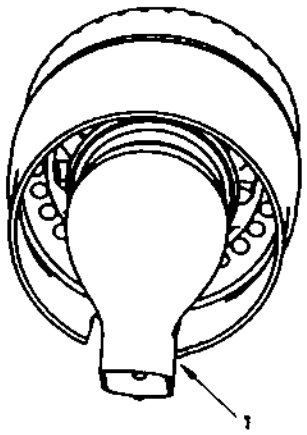
Fuel Nozzle Assembly Inspection
(Low Emissions Type)
Figure 202
(Task 73-00-00-210-001)



L-H4758 (0401)

1. Support Fairing (Heat Shield)
2. Corner Radius Of Air Scoop

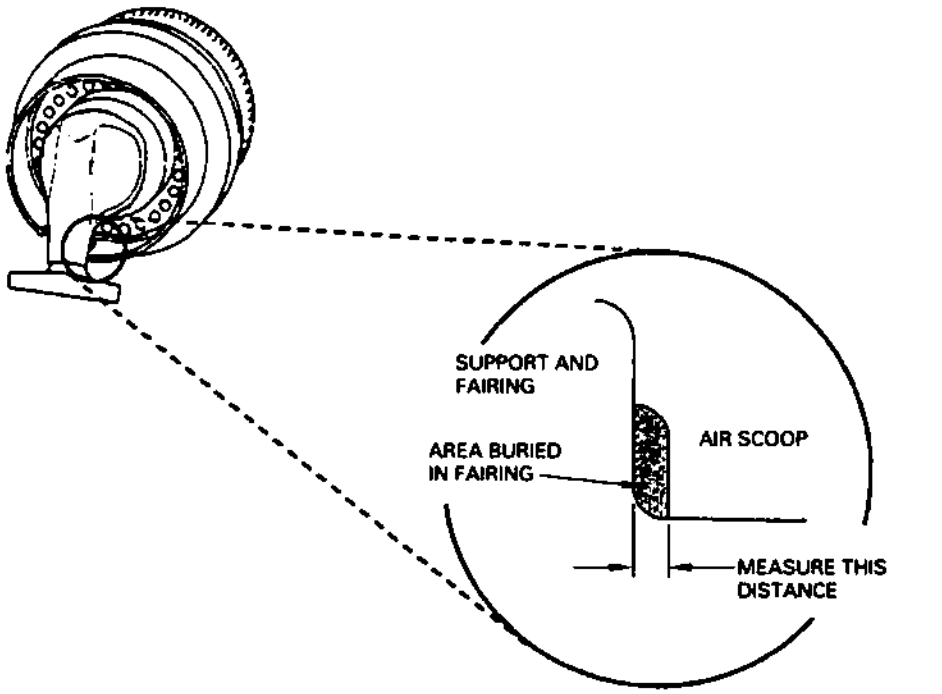
Air Scoop Penetration
Figure 203 (Sheet 1)
(Task 73-00-00-210-001)



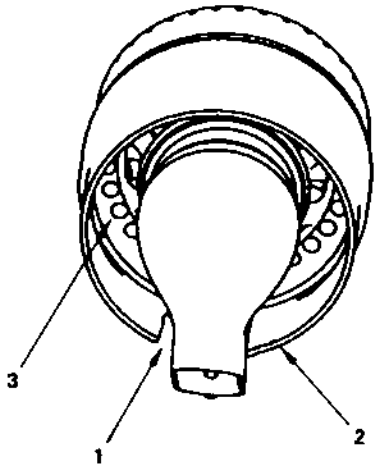
L-H4759 (0401)

1. Radius Completely Buried In Fairing

Air Scoop Penetration
Figure 203 (Sheet 2)
(Task 73-00-00-210-001)



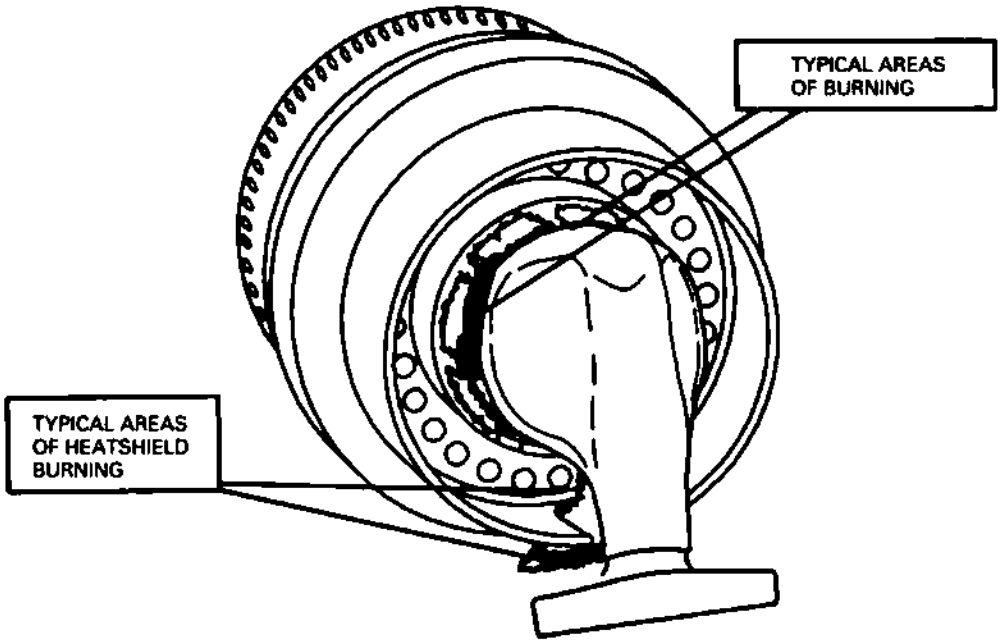
Air Scoop Penetration
Figure 204
(Task 73-00-00-210-001)



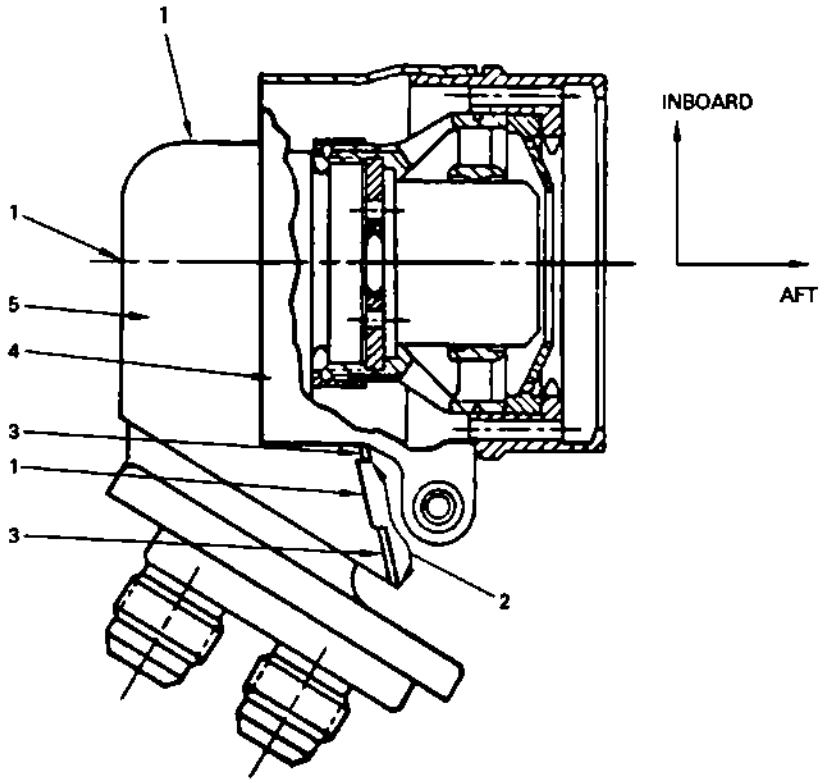
L-H4771 (0401)

1. Measure Gap Between The Air Scoop And Fairing
2. 0.060 Inch (1.524 mm), reference. Thickness Of Air Scoop.
3. 0.160 Inch (4.064 mm) Diameter, Reference. Diameter Of Fuel Nozzle Nut Deflector Cooling Air Holes.

Air Scoop Penetration
Figure 205
(Task 73-00-00-210-001)



Inspection Of Support Fairing
For Burning Or Melting
Figure 206
(Task 73-00-00-210-001)



L-H3795 (0401)

1. Tack Weld Locations
2. Seam Weld Location
3. Tabs
4. Airscoop
5. Support Fairing

Fuel Nozzle Support Fairing
Figure 207
(Task 73-00-00-210-001)

Task 73-00-00-610-001:

1. Preservation And Depreservation See Chapter/Section 72-00-00, SERVICING-00, For Specific Fuel System Preservation And Depreservation Procedures

Task 73-00-00-210-002:

1. Periodic Inspection

A. General

(1) These inspection procedures are a normal function of operating organizations. They consist of required inspections and minor adjustments necessary on the JT8D engine. The nature and conditions of engine operation determine the time interval between required inspections. For this reason, the intervals described in the Periodic Inspection Chart in this section are labeled Routine, Minor, and Major. If experience dictates a change in these procedures or time intervals, Pratt & Whitney Customer Technical Services Department should be contacted in order to make changes as the situation warrants.

(2) Engine compartment cleanliness is important because the extensive mass air flow tends to draw foreign objects into the engine. Thoroughly clean the entire engine compartment with a vacuum cleaner after completion of any work. Keep the compartment and the annular duct free of dirt, oil and grease, and remove all unused parts, such as nuts, washers, and pieces of lockwire. Immediately cover all apertures resulting from the disconnection of tubing or parts. Use external caps on all tube openings, not internal plugs.

(3) Carefully inspect the engine fuel and control system without dismantling to ensure that all connections are tight and free from leaks and that lines, tubing, and controls are secure and properly locked.

B. Periodic Inspection Chart

Component	Nature of Inspection	Fuel System Inspection Time			Remarks
		Routine	Minor	Major	
Engine Fuel Pump	a. Check for leakage.	X	X	X	
	b. Security of quick disconnect clamp (See Paragraph 2.C.)		X	X	
	NOTE: Do the "tap				

Component	Nature of Inspection	Fuel System Inspection Time			Remarks
		Routine	Minor	Major	
(CONTINUED)					
	and torque" procedure in this section subsequent to each 1000 hours (minimum) of operation.				
	c. Paper (cartridge) filter for foreign matter.		X	X	NOTE: The filter element must be checked frequently in new aircraft and after rework of fuel tanks.
Fuel De-Icing Air System	a. Security of air tubing and de-icing heater		X	X	
	b. Proper functioning of fuel differential pressure switch (see paragraph 2.D.)		X		
Hydro-mechanical Fuel Control	a. Security of control on pump and pump quick disconnect clamp.		X	X	
	b. Evidence of leakage.	X	X	X	
	c. Security of mechanical linkage.		X	X	

Component	Nature of Inspection	Fuel System Inspection Time Routine	Minor	Major	Remarks
(CONTINUED)					
	d. Fuel control inlet filter (coarse filter) for foreign matter or damaged screen.		X	X	NOTE: The filter screen must be checked frequently in new aircraft, and after rework of fuel tanks.
	e. Servo fuel filter for foreign matter or damaged screen.		X	X	See note under (d) above. Frequency of inspection is contingent on degree of contamination of main (coarse) filter.
	f. Fill the fuel control burner pressure bellows with silicone oil (to get the oil to the correct level and remove water).		X	X	See Paragraph F.
Pressurizing and Dump Valve	a. Security of accessible lines and fittings.		X	X	
	b. Security of mounting.		X	X	
	c. Inspect screen.		X*	X	

*NOTE: When fuel control screen contamination is found.

Component	Nature of Inspection	Fuel System Inspection Time			Remarks
		Routine	Minor	Major	
Fuel Manifold Nozzle Connecting Nuts (Conical Seat System Prior To SB 4484)	a. Remove combustion chamber and turbine fan ducts per Chapter/Section 72-70, Maintenance Practices.			X	Check torque on fuel manifold connections as directed whenever they are accessible.
	b. Unscrew and remove diffuser inner fan duct segments.				
	c. Retorque fuel nozzle connections per Paragraph 2.E.				
	d. Reinstall diffuser inner fan duct segments				
	e. Install combustion chamber and turbine fan ducts per Chapter/ Section 72-70, Maintenance Practices.				
PS4 Moisture Trap	See Section 72-00, Inspection/Check				

Task 73-00-00-210-003:

2. Specific Periodic Inspections

A. Draining Moisture Trap Housing

(1) Remove drain plug and packing from bottom of moisture trap (mounted on front of fuel control) and discard old packing.

(2) Drain all accumulated moisture from trap.

(3) Lubricate new packing with a thin layer of PWA 36500 Assembly Fluid and place seal on plug.

CAUTION: ENSURE THAT IF PLUG INCORPORATES 0.020 INCH HOLE CLEAR THROUGH, HOLE IN PLUG IS OPEN AND NOT OBSTRUCTED. DO NOT BLOCK HOLE WITH PLUG LOCKWIRE; LOCKWIRE SHOULD BE PASSED THROUGH ONLY ONE SIDE OF PLUG, NOT COMPLETELY ACROSS PLUG.

(4) Install drain plug and packing in bottom of moisture trap. Torque plug and secure with lockwire.

B. Draining Moisture Trap Housing (Cotter pin Configuration)

(1) Remove cotter pin and unfasten nut from bottom of moisture trap (underneath engine, inboard side of fuel control).

(2) Carefully draw housing straight downward out of cover.

(3) Drain all accumulated moisture.

(4) Install new packing, lubricated with a thin layer of PWA 36500 Assembly Fluid, on OD groove of moisture trap cover rod.

(5) Install new packing, lubricated with a thin layer of PWA 36500 Assembly Fluid, on OD groove of moisture trap housing.

(6) Insert moisture trap housing straight up into cover, being careful not to disrupt packings.

(7) Secure housing in place with washer and nut.

(8) Torque nut. Secure nut with cotter pin.

C. Checking Fuel Pump Quick-Disconnect Nut Security

R (1) Disconnect all tubes at the fuel pump, fuel control,
R and fuel heater that will prevent free movement of the
R fuel pump and control.

(2) Using hand force, attempt to move fuel pump and control up, down, side-to-side, and radially, inspecting for looseness of fuel pump at quick-disconnect nut.

NOTE: If any looseness or motion at fuel pump mounting point is found in step (2), remove pump and send it to overhaul facility for inspection of drive-shaft spline for damage which might have been caused by loose quick-disconnect nut.

(3) Remove lockwire at quick-disconnect locking bolt and apply 65 lb-in. tightening torque to bolt. If locking bolt does not turn when torque is applied, reinstall lockwire.

(4) If locking bolt turns when torque is applied, retorque to obtain final torque and nut-to-bracket distance specified in Chapter/Section 72-60-00, Inspection/Check-00, Reference 1102.

NOTE: Use technique of tapping nut with plastic mallet while torquing locking bolt, as described in Reference 1102.

(5) Check fuel pump quick-disconnect nut-to-gearbox gap by Chapter/Section 73-11-01, Removal/Installation-00.

(6) Lockwire nut locking bolt.

D. Checking Fuel Ice Warning System
See Figure 601.

(1) Set up test equipment as shown in figure, with source of clean air or nitrogen, regulator, and 0 - 15 psi pressure gage (± 1% accuracy with dial marked in 1/4 psi increments).

(2) Dump fuel from fuel filter housing and remove cover and filter element (see Chapter/Section 73-11-01, Removal/Installation-00).

(3) Actuate power supply to flight deck ice warning instrumentation.

(4) Connect PWA 33682 Nozzle to test line and coat rubber seal at tip of nozzle lightly with PWA 36500 Assembly Fluid.

R
R

CAUTION: IN FOLLOWING CHECK DO NOT EXCEED 20 PSIG PRESSURE.

(5) Insert nozzle in pressure discharge port near pressure switch as shown in figure. Hold firmly in place.

(6) Gradually increase pressure into base of switch through nozzle.

(7) Between 3 psig minimum and 8 psig maximum, ice warning light on flight deck should illuminate.

(8) Decrease line pressure. Between 6 psig maximum and 2 psig minimum, ice warning light should go out.

(9) Remove test nozzle and install fuel filter element and cover per Chapter/Section 73-11-01, Removal/Installation-00.

E. Fuel Nozzle Connection Retorquing

(1) On fuel system incorporating conical-seat fuel nozzle connections but without transfer tubes (incorporating SB 2722 but prior to SB 4484), retorque fuel nozzle connections as follows whenever connections are accessible:

(a) Cut lockwire from fuel nozzle connections.

CAUTION: DO NOT LOOSEN THE TUBE COUPLING NUTS IN THE FOLLOWING TORQUE PROCEDURE; APPLY TORQUE IN THE TIGHTENING DIRECTION ONLY.

(b) Starting at center of manifolds, torque tube coupling nuts 270 - 300 lb-in. using PWA 33523 Wrench.

NOTE: PWA wrench extends effective length of torque wrench. Adjust observed torque reading to allow for extension. See Chapter/Section 70-00-00, Standard Practices-00

(c) Wait five minutes; then, without loosening, torque all nuts again 270 - 300 lb-in. in same sequence as before. If any of the nuts were not up to 270 lb-in. wait five minutes and repeat torquing

procedure. This should be repeated until all nuts hold 270 lb-in.

NOTE: If after four torquing procedures, any of the nuts still show torque relaxation, replace manifold. Manifolds should be sent to accessory overhaul facility and inspected for proper alignment per Section 73-15-1 Component Maintenance Manual.

(d) Check all tube nuts to ensure they have remained at 270 lb-in. If not, replace manifold (see Note above). Lockwire fuel nozzle connections.

F. Servicing Of Fuel Control Burner Pressure Bellows
See Figure 602.

NOTE: This procedure makes sure that there is the correct level of silicone oil in the fuel control limiter cavity bellows, and that all water is removed from the bellows.

(1) Disconnect and remove the front Pb tube between the Ps4 moisture trap and the fuel control.

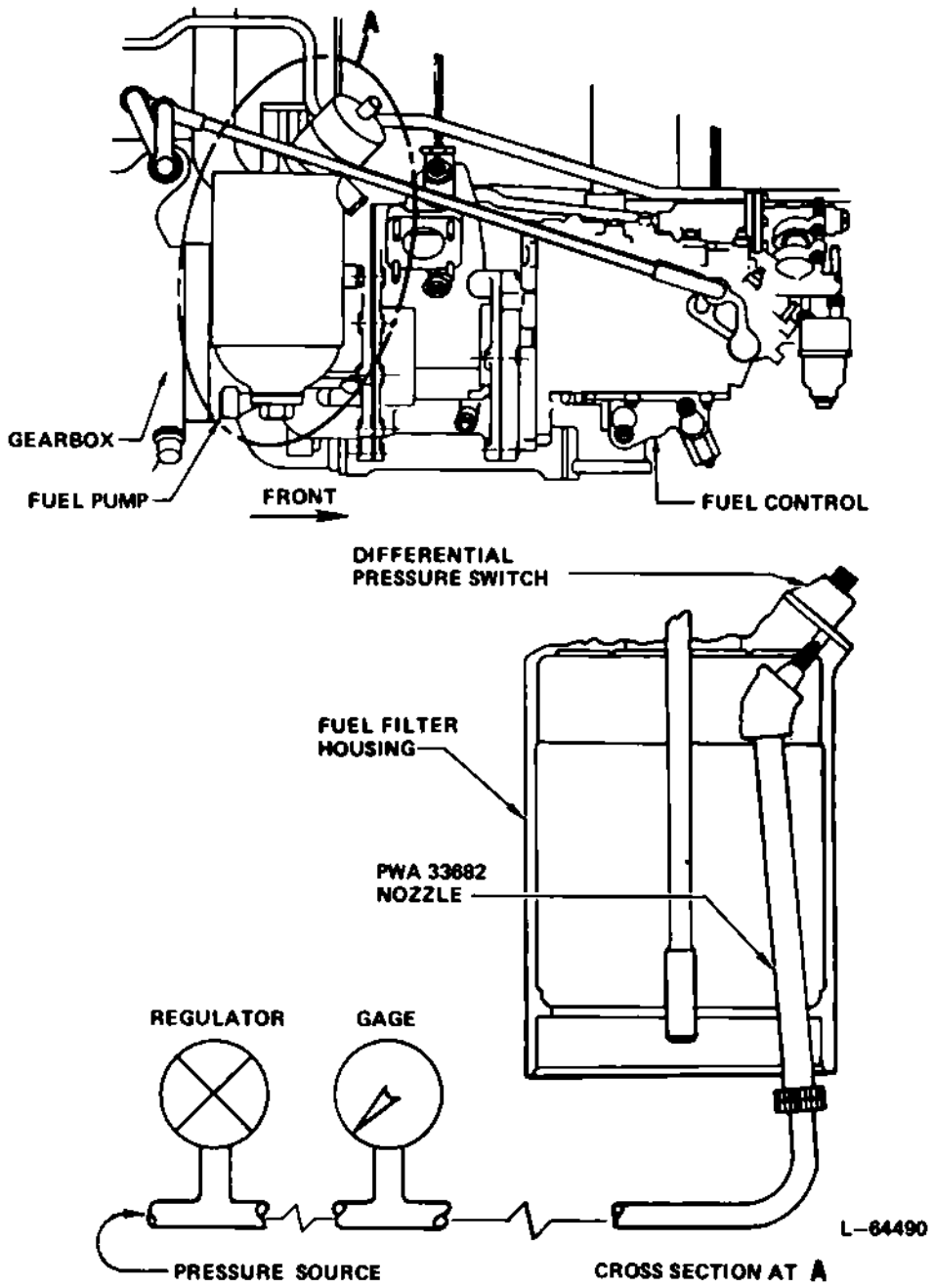
(2) Remove the adapter from the Ps4 inlet of the fuel control (see Figure 602).

(3) Use a needle or thin tube to fill the burner pressure bellows of the fuel control to the level of the inlet as shown in the figure.

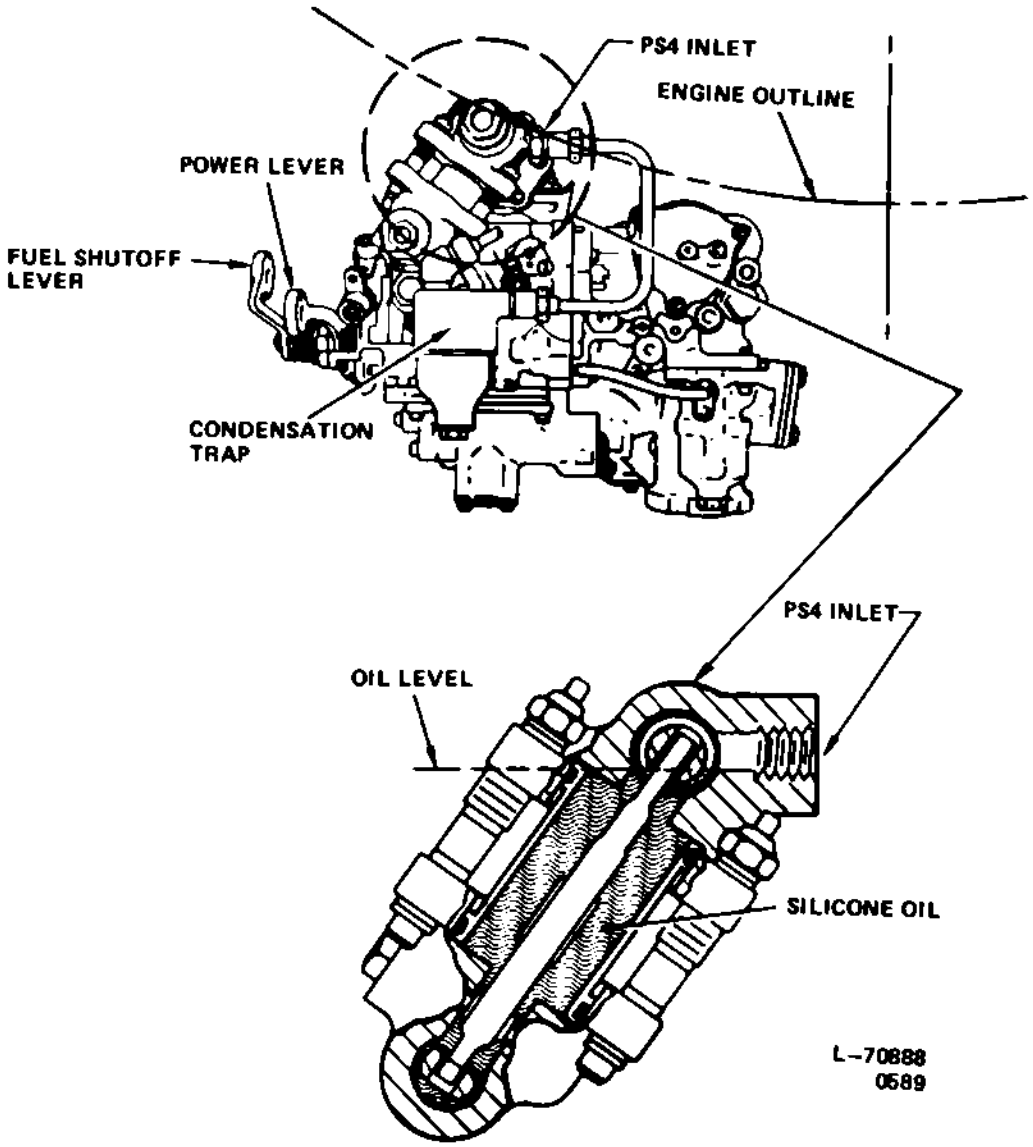
NOTE: Be careful to point the flow of silicone oil down into the cylindrical bellows that connects the upper and lower housings of the fuel control. Silicone oil is available as PCR Inc.'s Prosil 52 M-20 (to the Mil Spec MIL-S-81087) or Prosil 52 M-25 (to the commercial specification). These are available as Nyosil-M-20 and Nyosil-M-25 from PRC's distributor: Nye Lubricants P.O. Box 8927 New Bedford, MA 02742-8927 USA Tel: (508) 998-6721 FAX: (508) 997-5285

(4) Install the adapter (with a new preformed packing) in the fuel control housing.

(5) Install the front Pb tube between the Ps4 moisture trap and the fuel control. Torque the connections to standard torque and safety them with lockwire.



Fuel Differential
Pressure Switch Testing
Figure 601
(Task 73-00-00-210-003)



Burner Pressure Bellows
Cavity Oil Servicing
Figure 602
(Task 73-00-00-210-003)

Pratt & Whitney
JT8D MAINTENANCE MANUAL (PN 481671)

Please insert the revised pages into this manual and delete obsoleted pages in accordance with the following List of Effective Pages. Revised pages are indicated by the letter "R", added pages by the letter "A", and deleted pages by the letter "D". Superseded pages shall be removed and destroyed.

The List of Effective Pages records not only each page of subject revision but also each previously issued page which is still current. Blank pages and pages which are no longer current do not appear on this list. If there is any question about the currency of the maintained copy, it is recommended that each page of the manual be checked off against this List of Effective Pages. Any page which does not check out with this list, either by number or by date, shall be discarded. This list is reissued in its entirety whenever this manual section is revised.

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HIGHLIGHTS - 73 - FUEL

CHAPTER/ SECTION	PAGE NO	DESCRIPTION OF CHANGE	EFFECT OF CHANGE
73-11-01 REM/INST-00	401 -402	Added reference to post SB 6439 fuel pump shaft precautions. (SB 6439)	-ALL
73-11-01 INSP/CK-00	601 -605 607 -612 614 -616 618 -620	Added post SB 6439 fuel pump assembly details. (SB 6439)	-ALL

73 - FUEL

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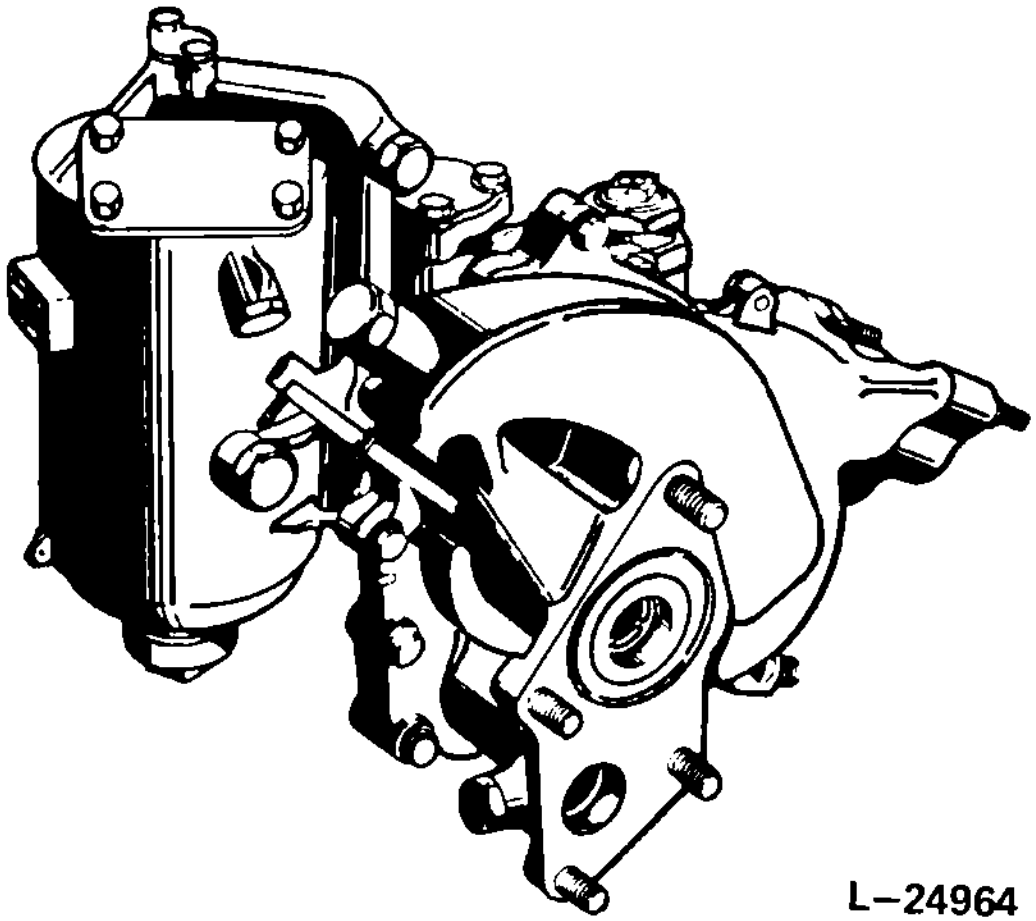
FUEL PUMP - DESCRIPTION-00

Task 73-11-01-990-001:

1. Description and Operation of the Fuel Pump

See Figure 1.

A. The main fuel gear pump consists of a single element gear stage with a high speed centrifugal boost stage. A cartridge type relief valve is incorporated to limit the pressure rise across the gear stage. The unit provides a rigid mounting pad arrangement and a rotational splined drive for the fuel control. An integral fuel filter containing a replaceable micronic barrier filter element is located between the discharge of the centrifugal stage and the inlet of the gear stage. Should the pressure drop across the filter exceed a predetermined limit, a bypass valve directs flow into the gear stage. A mounting pad is provided on the filter housing to permit the use of a remote reading differential pressure warning device. An accessible and removable cover forms the lower portion of the sump area of the filter housing. This cover contains a plug-type valve for draining both the sump and center tube of the filter element. In the event of a malfunction of the boost stage, a bypass valve opens into the inlet passage of the pump to direct flow into the gear stage. This is held normally closed by a light spring force and remains closed due to boost stage pressure. Outlet and return ports are provided between the boost stage discharge and the filter inlet for installation of an external fuel heater. A drive shaft seal drain is located in the lower extremity of the mounting flange.



Main Fuel Gear Pump
Figure 1
(Task 73-11-01-990-001)

EFF: -ALL

Task 73-11-01-450-001:

1. Removal/Installation of Fuel Pump

A. Removal

(1) Disconnect fuel control power lever linkage.

(2) Remove high pressure air sense line connected to fuel control.

(3) Remove external fuel lines connected to fuel control.

(4) Remove inlet temperature bulb and lead from inlet case.

NOTE: Inlet temperature bulb and lead are an integral part of fuel control. Carefully coil lead to avoid kinking and wrap temperature bulb in protective paper.

(5) On JT8D-17R and -17AR engines, disconnect electrical connections to fuel control RTT actuating solenoid and indication switch.

(6) Remove external fuel lines connected to fuel pump.

(7) Remove high pressure air tubes connected to the fuel heater.

(8) Loosen and back off bolt which locks fuel pump quick-disconnect nut to gearbox bracket (certain engines incorporate locking bolt in bracket instead of in nut).

CAUTION: DO NOT LET WEIGHT OF FUEL CONTROL AND PUMP BE TRANSMITTED TO PUMP SPLINES DURING REMOVAL.

R CAUTION: BE CAREFUL DURING REMOVAL OF A POST-SB 6439
R PUMP ASSEMBLY TO KEEP THE DRIVESHAFT WITH THE
R PUMP (IT IS POSSIBLE THAT THE DRIVESHAFT CAN
R COME OUT AND FALL TO THE GROUND).

R (9) Hold the fuel pump and turn the fuel pump
R quick-disconnect nut counterclockwise (front view) to
R disengage the pump from the mating rear coupling.
R Then carefully pull the pump and control forward to
R disengage the mating splines.

R (a) If (during pump removal) the driveshaft pulls out
R of a post-SB 6439 pump (P&W 835800 or 835900),
R clean and examine the the driveshaft as specified
R in Inspection/Check-00.

(10) Remove locknuts and washers securing quick-disconnect nut and front coupling assembly to flange of fuel pump; then remove bolts, front coupling, nut assembly, and gasket from fuel pump mounting flange.

(11) Loosen and remove nuts securing fuel control to pump. Separate control from pump.

NOTE: Remove upper hexnut securing fuel pump to fuel control using PWA 45246 Wrench Adapter for better access.

B. Installation
See Figure 401.

(1) Lubricate two new seals with a thin layer of PWA 36500 Assembly Fluid and position into grooves on bosses on splined drive end of fuel control.

(2) Coat fuel control shaft splines with engine oil. Install fuel control over studs on upper end of pump, aligning splines on control shaft with splines in fuel pump.

CAUTION: MAKE SURE THAT FUEL CONTROL TO PUMP DRIVE SPLINE IS PROPERLY ENGAGED BEFORE PUTTING WASHERS AND NUTS ON PUMP STUDS. IF ENGINE IS STARTED WITH CONTROL MISASSEMBLED, IT WILL CONTINUE TO ACCELERATE WITH NO POWER LEVER RESPONSE. IN THE EVENT THIS OCCURS CONTROL MUST BE REMOVED FOR FUEL CONTROL DRIVESHAFT BEARING INSPECTION.

(3) Secure control to pump with washers and nuts, using different size washer and nut on proper stud, and securing airframe brackets as required.

NOTE: Install hexnut on pump and control flange using PWA 45246 Wrench Adapter (this tool has three-inch effective length). Attach standard 3/8 inch drive torque wrench to adapter.

(4) Install fuel de-icing heater as follows:

(a) Reposition assembled fuel pump and fuel control so that side of fuel pump with three studs is up.

(b) Coat seals with PWA 36500 Assembly Fluid and position into grooves on both ends of two transfer tubes. Insert tubes into openings in fuel pump pad that contains two closest studs.

(c) Install fuel de-icing heater over fuel pump studs. Secure in place using brackets, washers, and locknuts (shorter bracket, with angle away from pump mounting flange and outward, on stud farthest from mounting flange, and longer bracket, with angle away from pump mount flange and inward, to be on single boss stud). Torque nuts.

(5) Quick-Disconnect Nut Assembly - Installation on Fuel Pump

(a) Position assembled pump, control (and heater) on bench with pump mounting flange facing operator.

(b) Place fuel pump front coupling in quick-disconnect nut assembly and install, with new gasket, on fuel pump mounting flange (position coupling so that bolthole adjacent to larger dowel pinhole aligns with second hole counterclockwise from fuel drain boss in flange OD.)

(c) Secure with bolts (bolt heads in coupling grooves), washers, and nuts. Torque nuts.

(6) Installation of Assembled Fuel Pump and Fuel Control and Fuel Heater See Figure 402.

(a) Inspect bolt head height of bolts securing quick-disconnect rear coupling to gearbox as shown in Figure 402. If bolt head height is over maximum, machine head within limits given and reinstall bolt.

NOTE: PN 313595 or 572311 bolts are reidentified to PN 769386 after machining per step (a).

(b) Install new packing, lubricated with a thin layer of PWA 36500 Assembly Fluid in groove on OD of fuel pump quick-disconnect front coupling.

R
R

(c) Lubricate new packing with a thin layer of PWA 36500 Assembly Fluid and install it into groove behind splines on mount end of fuel pump (assembled pump, control, and fuel heater).

CAUTION: THE FUEL PUMP DRIVE SPLINES ARE LUBRICATED BY ENGINE OIL WHICH CIRCULATES THROUGH OIL FEED HOLES DRILLED IN ACCESSORY DRIVE GEARSHAFT. USE ONLY ENGINE OIL TO LUBRICATE THE PUMP AND GEARSHAFT MATING SPLINES. DO NOT USE PLASTI-LUBE NO. 3 OR SIMILAR LUBRICANTS WHICH MIGHT PLUG OIL FEED HOLES.

(d) Coat fuel pump shaft mating splines with engine oil.

CAUTION: DO NOT LET WEIGHT OF FUEL CONTROL AND PUMP BE TRANSMITTED TO PUMP SPLINES DURING INSTALLATION.

(e) Install fuel pump and control on accessory and component drives gearbox assembly.

(f) Secure pump by tightening quick-disconnect nut assembly to engage threads of rear coupling. Lock nut assembly by engaging detail nut with bolt of nut bracket.

CAUTION: AFTER TIGHTENING QUICK-DISCONNECT NUT LOCKING BOLT IN FOLLOWING PROCEDURE, ENSURE THAT REAR FACE OF QUICK-DISCONNECT NUT IS NOT TOUCHING FACE OF GEARBOX MOUNTING PAD. GAP BETWEEN NUT AND FACE OF PAD MUST BE 0.010 INCH MINIMUM. SEE FIGURE 402.

(g) Tighten quick-disconnect nut by Chapter/Section 72-60-00 Inspection/Check-00, Reference 1102. 1 Use technique of tapping nut with plastic mallet while tightening locking bolt, as directed in Reference 1102. 2 Check nut-to-gearbox gap as shown in Figure 402. 3 Lockwire locking bolt.

(7) Install high pressure air tubes on fuel de-icing heater.

(8) Install external fuel lines connected to fuel pump.

R
R

(9) Install inlet temperature bulb in inlet case.

(10) Secure fuel lines to fuel control.

(11) Secure high pressure air sense line to control.

(12) Connect fuel control power lever linkage.

(13) On JT8D-17R and -17AR engines, connect electrical lines to fuel control RTT solenoid and indication switch.

Task 73-11-01-450-002:

2. Fuel Pump Filter Cartridge Replacement

A. Replacement of Filter Cartridge Assembly

NOTE: Replacement should be accomplished at normal inspection period or sooner if excessive contamination is suspected.

(1) Remove cotterpin from valve body.

(2) Using 1/4 inch socket-head wrench, remove filter cover valve (drain plug) from center of 13/16 inch hexagonal valve body section at bottom of filter cover, allowing fuel to drain from filter.

(3) When all fuel has been drained, remove filter cover assembly by turning 13/16 inch hexagonal valve body section at bottom of filter cover to jack cover assembly out of filter cavity. Remove filter cartridge.

(4) Examine the filter, the filter cavity and the filter cover. Be sure that the filter cartridge gaskets are on the filter cartridge and not caught in the housing cavity or the cover. Remove the gaskets if necessary. Discard the filter cartridge. Install the protection covers.

(5) Replace preformed packings on valve (drain plug), valve body and cover assembly with new packings coated with petrolatum.

(6) Install valve (drain plug) into valve body. Torque valve (drain plug) to 60 - 80 lb-in.

CAUTION: INSTALL THE CORRECT FUEL FILTER CARTRIDGE FOR THE ENGINE MODEL. LOOK AT THE CARTRIDGE TO FIND THE PART NUMBER AND ENGINE MODEL MARKS. IF THE CARTRIDGE IS INCORRECT FOR THE ENGINE MODEL, THIS CAN CAUSE CONTAMINATION OF THE FUEL SYSTEM AND UNSATISFACTORY ENGINE OPERATION. IT IS POSSIBLE THAT THE OLD GASKETS FROM THE REMOVED FILTER CARTRIDGE REMAIN INSIDE THE FUEL FILTER HOUSING CAVITY OR COVER. BE SURE YOU EXAMINE THE FILTER CAVITY AND COVER. REMOVE THE OLD FILTER GASKETS FROM THE CAVITY AND COVER IF NECESSARY, OR DAMAGE TO THE ENGINE CAN RESULT.

(7) Examine the filter housing cavity and the filter cover. Be sure that the old gaskets from the removed filter cartridge do not stay in the cavity or the cover. Remove the old gaskets if necessary.

(8) Place new cartridge assembly on cover assembly and insert into filter cavity. Tighten cover using 13/16 hexagonal valve body section to torque indicated in Chapter/Section 72-00-00, Inspection/Check-02, Fits And Clearances, Reference 115.

(9) Install cotterpin in place and bend tabs.

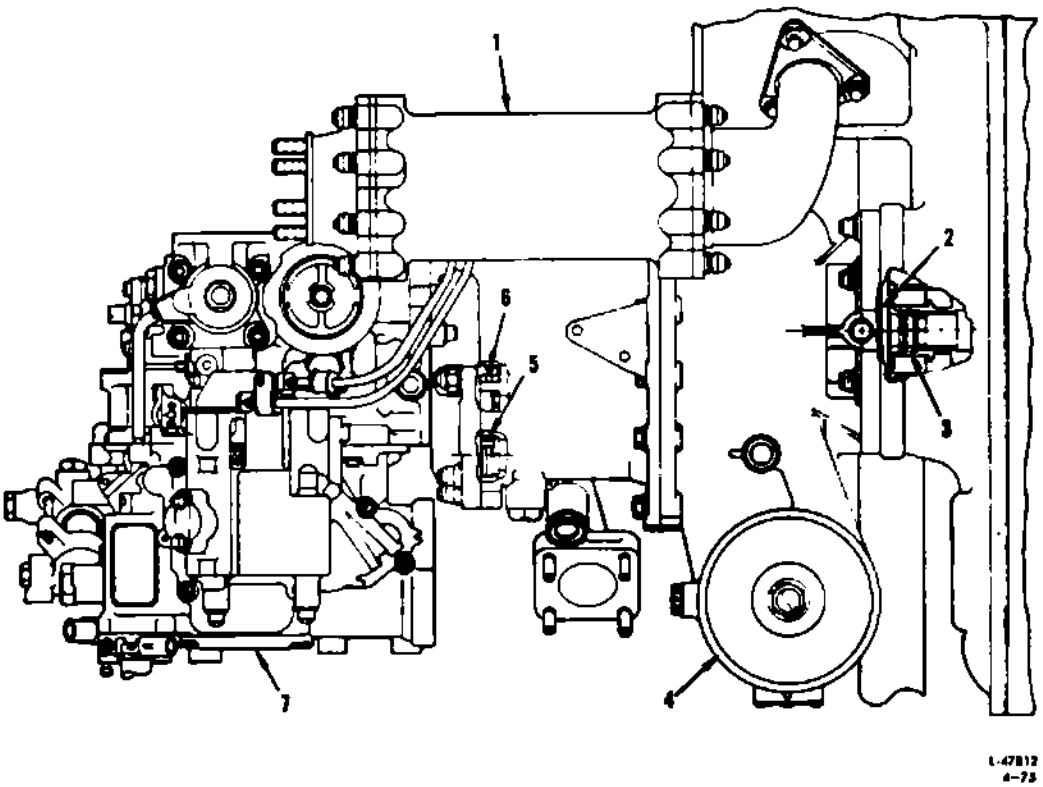
B. Testing and Calibration
No testing or calibration is required after replacement of filter cartridge assembly.

Task 73-11-01-990-002:

3. Tools

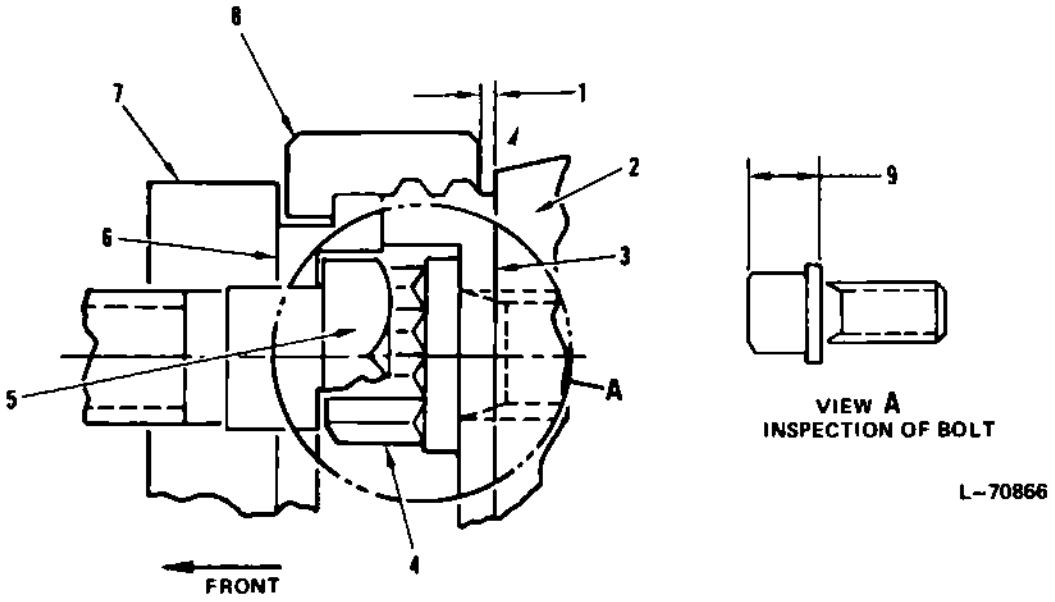
A. Special Tools

PWA 45246 Wrench Adapter



1. Fuel Heater Assembly
2. Gasket
3. Packing
4. Fuel Pump
5. Seal
6. Seal
7. Fuel Control

Fuel Pump And Control
Figure 401
(Task 73-11-01-990-002)



CROSS-SECTION THRU FUEL PUMP QUICK-DISCONNECT NUT

1. 0.010 Inch Minimum Clearance
2. Gearbox Surface (Fuel Pump Pad)
3. Quick-Disconnect Rear Coupling
4. Rear Coupling Retaining Bolts
5. Front Coupling Retaining Bolts
6. Quick-Disconnect Front Coupling
7. Fuel Pump Mounting Flange
8. Quick-Disconnect Nut
9. 0.340 - 0.360 Inch. Machine As Required.

Fuel Pump Quick-Disconnect
Coupling And Nut Assembly
Figure 402
(Task 73-11-01-990-002)

Task 73-11-01-210-001:

1. Fuel Pump Driveshaft Removal And Inspection (JT8D-1,-1A,-1B, -7,-7A,-7B,-9,-9A,-11,-15, and -15A)

A. Prerequisites

(1) Remove the fuel pump and control package by Section 73-11-01, Removal/Installation-00 (Task 73-11-01-450-001).

B. Procedure

(1) General

(a) The procedure that follows removes the driveshaft from the fuel pump, gives the driveshaft a spline inspection, and replaces the shaft in the pump after the spline is lubricated.

(b) If the fuel pump is removed and will go back on a engine to be used again, do this procedure when the fuel pump is removed from the engine and is on a bench.

(c) Do this inspection and spline lubrication procedure when the fuel pump is removed from the gearbox.

NOTE: This procedure is applicable only to fuel pumps that were maintained only with parts and processes approved in the Argo-Tech Overhaul Manual, Chapter/Section 73-11-1.

CAUTION: MAKE SURE THAT FUEL PUMP PARTS ARE NOT DAMAGED DURING THIS PROCEDURE. BE CAREFUL WHEN PUMP PARTS ARE REMOVED OR TOUCHED.

(2) Driveshaft removal

R (a) Pre-SB 6439 (P&W PN 243600, 278200, 358200,
R 371900). See Figure 602 (Sheet 1).

1 Remove the four bolts and washers (1 and 2 in the figure) that attach the outer seal assembly (3) and remove the seal. Remove and discard the packing (4) from the groove in the pump housing.

CAUTION: BEFORE YOU REMOVE THE PUMP SHAFT OR ITS MATING PARTS, USE BLUE DYE TO PUT MARKS ON THE SHAFT AND MATING PARTS TO RECORD THEIR RADIAL POSITION. BE SURE TO PUT THESE MARKS ON THE ROTATING SEAL RING (6), INTERNAL DRIVER GEAR (11), AND PUMP SHAFT (5).

2 Pull the driveshaft (5) out of the pump.

3 Remove the collar retaining ring (10) and the split collar (9) from the shaft. Remove the rotating seal ring (6) and washer (8) from the shaft.

4 Remove the packing (7) from the rotating sealing ring (6) and discard the packing.

5 Put a cover on the pump opening to keep out contamination.

R (b) Post-SB 6439 (P&W PN 835800). See Figure 602
R (Sheet 2).

R 1 Remove the four bolts (Index 1 in the figure)
R that attach the outer seal assembly (2) and
R remove the seal. Remove and discard the
R packing (3) from the groove in the pump
R housing.

R 2 Pull the driveshaft (4) out of the pump by
R hand. Make sure that the retaining ring (7)
R was removed with the driveshaft.

R NOTE: If the retaining ring was not on the
R driveshaft when the driveshaft came out
R of the pump, remove the ring from the
R pump and examine the pump for spline
R wear.

R 3 Remove the collar retaining ring (5) and the
R split collar (6) from the driveshaft.

R 4 Put a cover on the pump opening to keep out
R contamination.

(3) Driveshaft inspection

(a) Clean all removed metal parts fully by SPOP 208. See Section 70-21-00, Standard Practices Manual, PN 585005. Use a brush on unwanted material which is difficult to remove. Dry the parts with filtered compressed air.

R (b) Clean the internal spline of the inner pump driver
R gear, Index 11 in Figure 602 (Sheet 1) or Figure
R 602 (Sheet 2) with a dry cotton swab to remove as
R much grease as possible.

R (c) Examine the inner spline of the pump driveshaft (the end that goes in the pump). Use a dial indicator to measure the depth of wear on the spline. Compare worn areas to adjacent spline areas which are not worn. If the spline wear is in the permitted area in Figure 601, continued operation of the fuel pump is permitted. If the spline wear is not in the permitted area of the figure, action is necessary to correct why the unsatisfactory spline wear occurred (refer to Maintenance Advisory Notice MAN-JT8D-2-04) before the engine can continue in service. If there is more than 0.004 inch wear on the shaft spline, send the pump assembly to overhaul.

R (4) Fuel Pump Shaft Installation Pre-SB 6439 (P&W PN
R 243600, 278200, 358200, 371900). See Figure 602 (Sheet
R 1).

(a) Install a new packing (7), Argo-Tech PN 211711, lubricated with PWA 36500 lubricant, on the rotating seal ring (6). Install the seal ring on the fuel pump driveshaft.

(b) Install the washer (8) on the shaft against the inner face of the seal ring.

(c) Install the split collar (9) on the driveshaft with the larger diameter face of the split collar adjacent to the washer (8).

(d) Install the ring (10) to hold the split collar in position on the shaft.

WARNING: REFER TO THE MANUFACTURER/SUPPLIER'S MATERIAL SAFETY DATA SHEET FOR INSTRUCTIONS ON HOW TO USE KRYTOX 283AD SAFELY.

(e) Apply four grams of Krytox 283AD lubricant to the inner (rear) end of the driveshaft. Install the driveshaft (with the rotating seal ring assembly) carefully into the driver gear (11). Engage the seal ring with the internal driver gear (in the same radial position as it was at disassembly).

NOTE: Krytox 283AD is available from Dupont Corporation, Wilmington, DE 19898

(f) Install a new packing (4) (MS29513-140), lubricated with PWA 36500 lubricant, on the outer seal assembly (3). Install the seal assembly around the outer end of the driveshaft and attach it with four bolts (1) and washers (2). Torque the bolts to 25 - 30 lb-in. Safety the bolts with lockwire.

(g) When the assembly is completed, use Argo-Tech tool 207954 Crank to turn the pump through the shaft. Make sure that the shaft turns freely and does not rub. If there is too much friction, or if the shaft rubs against adjacent parts, send the pump to overhaul.

R (5) Fuel Pump Shaft Installation Post-SB 6439 (P&W PN
R 835800). See Figure 602 (Sheet 2).

R (a) Install the retaining ring (7) in the spline
R groove at the end of the driveshaft (4).

R (b) Install the split collar (6) on the driveshaft
R with the larger diameter face of the split collar
R toward the smaller spline end of the driveshaft
R (4).

R (c) Install the retaining ring (5) in the groove of
R the split collar segments to hold the collar in
R position on the shaft.

R WARNING: REFER TO THE MANUFACTURER/SUPPLIER'S
R MATERIAL SAFETY DATA SHEET FOR
R INSTRUCTIONS ON HOW TO USE KRYTOX 283AD
R SAFELY.

R (d) Apply four grams of Krytox 283AD lubricant to the
R inner (rear) end of the driveshaft. Install the
R driveshaft (with the rotating seal ring assembly)
R carefully into the driver gear (11). Engage the
R seal ring with the internal driver gear (in the
R same radial position as it was at disassembly).

R NOTE: Krytox 283AD is available from Dupont
R Corporation, Wilmington, DE 19898.

R (e) Install a new packing (3) (MS29513-140),
R lubricated with PWA 36500 lubricant, on the outer
R seal assembly (2). Install the seal assembly
R around the outer end of the driveshaft and attach
R it with four bolts (1). Torque the bolts to 25 -
R 30 lb-in. Safety the bolts with lockwire.

R (f) When the assembly is completed, use Argo-Tech tool
R 207954 Crank to turn the pump through the shaft.
R Make sure that the shaft turns freely and does not
R rub. If there is too much friction, or if the
R shaft rubs against adjacent parts, send the pump
R to overhaul.

C. Postrequisites

(1) Install the fuel pump and fuel control package by Section 73-11-01, Removal/Installation-00 (Task 73-11-01-450-001).

Task 73-11-01-210-002:

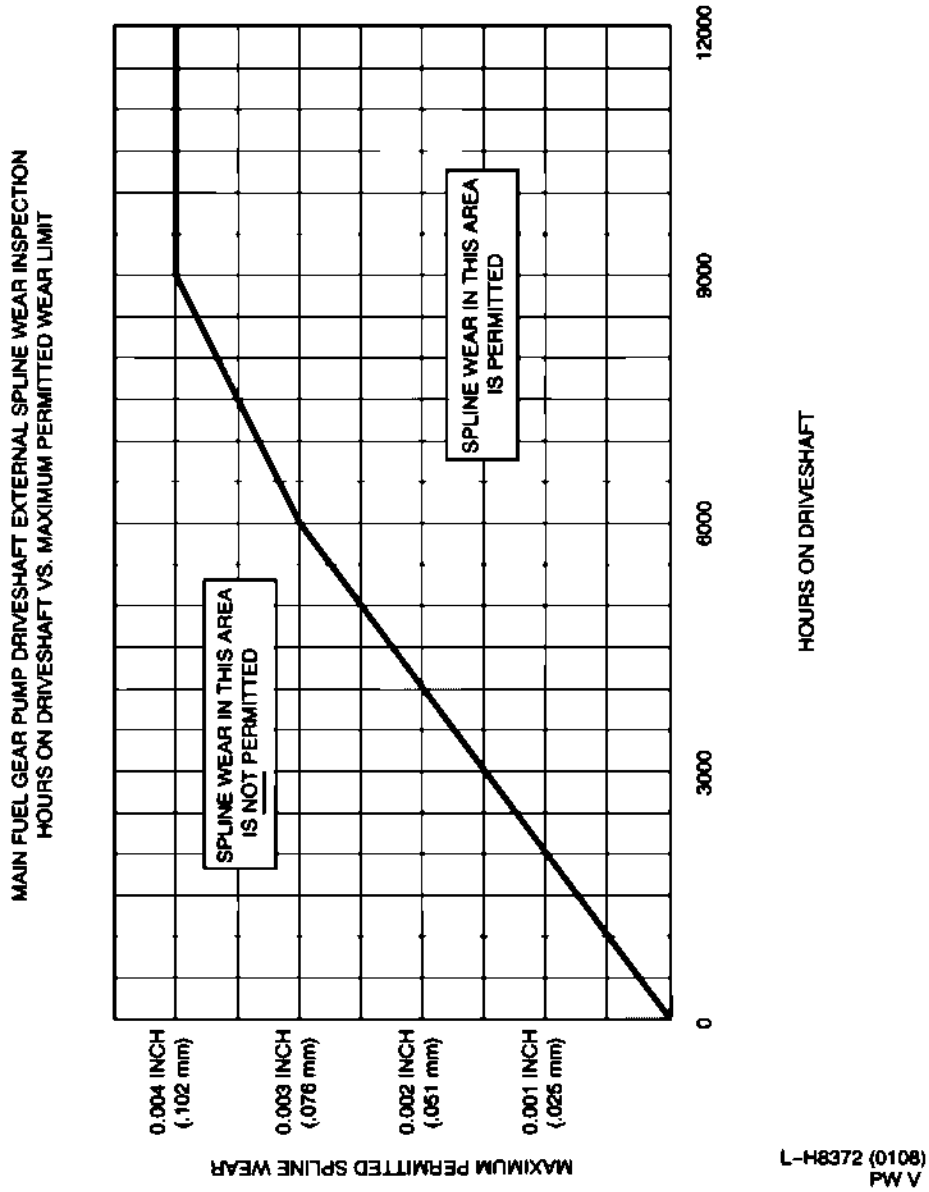
2. Fuel Pump Driveshaft Removal And Inspection (JT8D-17,-17A,-17R, 17AR)

A. Prerequisites

(1) Remove the fuel pump and control package by Section 73-11-01, Removal/Installation-00 (Task 73-11-01-450-001).

B. Procedure

(1) General



Fuel Pump Driveshaft
Spline Wear Limits
Figure 601
(Task 73-11-01-210-001)

(a) The procedure that follows removes the driveshaft from the fuel pump, gives the driveshaft a spline inspection, and replaces the shaft in the pump after the spline is lubricated.

(b) If the fuel pump is removed and will go back on a engine to be used again, do this procedure when the fuel pump is removed from the engine and is on a bench.

(c) Do this inspection and spline lubrication procedure when the fuel pump is removed from the gearbox.

NOTE: This procedure is applicable only to fuel pumps that were maintained only with parts and processes approved in the Argo-Tech Overhaul Manual, Chapter/Section 73-11-2.

CAUTION: MAKE SURE THAT FUEL PUMP PARTS ARE NOT DAMAGED AND THAT CONTAMINATION DOES NOT GET IN THE PUMP DURING THIS PROCEDURE. BE CAREFUL WHEN PUMP PARTS ARE REMOVED OR TOUCHED.

R (2) Driveshaft Removal Pre-SB 6439 (P&W PN 384300). See
R Figure 603 (Sheet 1).

(a) Remove the four bolts and washers (1 and 2 in the figure) that attach the outer seal assembly (3) and remove the seal. Remove and discard the packing (4) from the groove in the pump housing.

CAUTION: BEFORE YOU REMOVE THE PUMP SHAFT OR ITS MATING PARTS, USE BLUE DYE TO PUT MARKS ON THE SHAFT AND MATING PARTS TO RECORD THEIR RADIAL POSITION. BE SURE TO PUT THESE MARKS ON THE ROTATING SEAL RING (5), INTERNAL DRIVER GEAR (12), AND PUMP SHAFT (10). KEEP ALL SEAL SHIMS (6) FOUND, AND MAKE SURE THAT THEY GO BACK ON THE DRIVER GEAR AT ASSEMBLY.

(b) Pull the driveshaft (10) out of the pump.

(c) Remove the spring retaining washer (9), and the rotating seal ring (5), shims (6), outer urethane washer (7), spring (8), and inner urethane washer (7).

(d) Remove the packing (11) from the internal pump driver gear (12).

(e) Put a cover on the pump opening to keep out contamination.

CAUTION: MAKE SURE THAT FUEL PUMP PARTS ARE NOT DAMAGED AND THAT CONTAMINATION DOES NOT GET IN THE PUMP DURING THIS PROCEDURE. BE CAREFUL WHEN PUMP PARTS ARE REMOVED OR TOUCHED.

R (3) Driveshaft Removal Post-SB 6439 (P&W PN 835900). See
R Figure 603 (Sheet 2).

R (a) Remove the four bolts (1 in the figure) that
R attach the outer seal assembly (3) and remove the
R seal. Remove and discard the packing (3) from the
R groove in the pump housing.

R CAUTION: BEFORE YOU REMOVE THE PUMP SHAFT OR ITS
R MATING PARTS, USE BLUE DYE TO PUT MARKS
R ON THE SHAFT AND MATING PARTS TO RECORD
R THEIR RADIAL POSITION. BE SURE TO PUT
R THESE MARKS ON THE ROTATING SEAL RING
R (4), INTERNAL DRIVER GEAR (12), AND
R DRIVESHAFT (9). KEEP ALL SEAL SHIMS (5)
R FOUND, AND MAKE SURE THAT THEY GO BACK
R ON THE DRIVER GEAR AT ASSEMBLY.

R (b) Pull the driveshaft (9) out of the pump.

R (c) Remove the spring retaining washer (8), rotating
R seal ring (4), shims (5), outer urethane washer
R (6), spring (7), and inner urethane washer (6).

R (d) Remove the packing (11) from the internal pump
R driver gear (12).

R (e) Put a cover on the pump opening to keep out
R contamination.

(4) Driveshaft inspection

(a) Clean all removed metal parts fully by SPOP 208. See Section 70-21-00, Standard Practices Manual, PN 585005. Use a brush on unwanted material which is difficult to remove. Dry the parts with filtered compressed air.

(b) Clean the internal spline of the inner pump driver gear (12) with a dry cotton swab to remove as much grease as possible.

(c) Examine the inner spline of the pump driveshaft (the end that goes in the pump). Use a dial indicator to measure the depth of wear on the spline. Compare worn areas to adjacent spline areas which are not worn. If the spline wear is in the permitted area in Figure 601, continued operation of the fuel pump is permitted. If the spline wear is not in the permitted area of the figure, action is necessary to correct why the unsatisfactory spline wear occurred (refer to Maintenance Advisory Notice MAN-JT8D-2-04) before the engine can continue in service. If there is more than 0.004 inch wear on the shaft spline, send the pump assembly to overhaul.

R (5) Fuel Pump Driveshaft Installation Pre-SB 6439 (P&W PN
R 384300). See Figure 603 (Sheet 1).

(a) Install the retaining washer (9) on the internal driver gear (12). Install the packing (11) (Argo-Tech PN 94512-23), lubricated with PWA 36500 lubricant, in the groove of the gear.

(b) Assemble all shims (6) found at disassembly, the outer washer (7), spring (8), and the inner washer (7) on the rotating seal ring (5). Put the rotating seal ring and its shims, washers, and spring on the outer end (small spline) of the pump driveshaft.

WARNING: REFER TO THE MANUFACTURER/SUPPLIER'S MATERIAL SAFETY DATA SHEET FOR INSTRUCTIONS ON HOW TO USE KRYTOX 283AD SAFELY.

(c) Apply four grams of Krytox 283AD lubricant to the inner (rear) end of the driveshaft. Install the driveshaft (with the rotating seal ring assembly) carefully into the driver gear (12). Engage the seal ring with the internal driver gear (in the same radial position as it was at disassembly). Make sure that the shims (6) and the inner and outer washers (7) stay in the correct position as
R shown in Figure 603 (Sheet 3), and make sure that

the packing (11) in the driver gear groove is not pushed out of position.

NOTE: Krytox 283AD is available from Dupont Corporation, Wilmington, DE 19898.

(d) Install a new packing (4) (MS29513-140), lubricated with PWA 36500 lubricant, on the outer seal assembly (3). Install the seal assembly around the outer end of the driveshaft and attach it with four bolts (1) and washers (2). Torque the bolts to 25 - 30 lb-in. Safety the bolts with lockwire.

(e) When the assembly is completed, use Argo-Tech tool 207954 Crank to turn the pump through the shaft. Make sure that the shaft turns freely and does not rub. If there is too much friction, or if the shaft rubs against adjacent parts, send the pump to overhaul.

R (6) Fuel Pump Driveshaft Installation Post-SB 6439 (P&W PN
R 835900). See Figure 603 (Sheet 1).

R (a) Install the retaining washer (8) on the internal
R driver gear (12). Install the packing (11)
R (Argo-Tech PN 94512-23), lubricated with PWA 36500
R lubricant, in the groove of the gear.

R (b) Assemble all shims (5) found at disassembly, the
R outer washer (6), spring (7), and the inner washer
R (6) on the rotating seal ring (4). Put the
R rotating seal ring and its shims, washers, and
R spring on the outer end (small spline) of the pump
R driveshaft.

R WARNING: REFER TO THE MANUFACTURER/SUPPLIER'S
R MATERIAL SAFETY DATA SHEET FOR
R INSTRUCTIONS ON HOW TO USE KRYTOX 283AD
R SAFELY.

R (c) Apply four grams of Krytox 283AD lubricant to the
R inner (rear) end of the driveshaft. Install the
R driveshaft (with the rotating seal ring assembly)
R carefully into the driver gear (12). Engage the
R seal ring with the internal driver gear (in the
R same radial position as it was at disassembly).
R Make sure that the shims (5) and the inner and
R outer washers (6) stay in the correct position as

R shown in Figure 603 (Sheet 3), and make sure that
R the packing (11) in the driver gear groove is not
R pushed out of position.

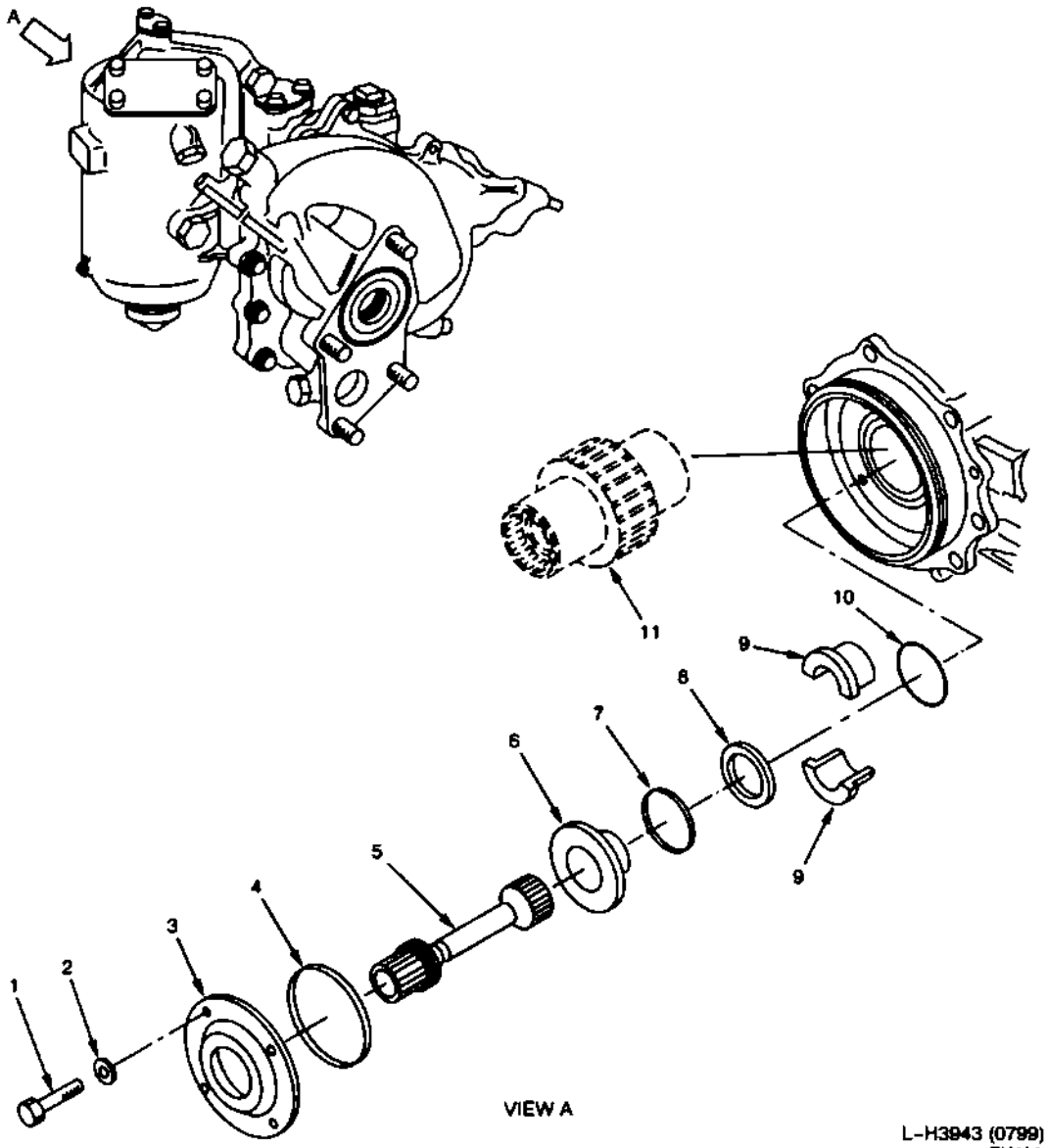
R NOTE: Krytox 283AD is available from Dupont
R Corporation, Wilmington, DE 19898.

R (d) Install a new packing (4) (MS29513-140),
R lubricated with PWA 36500 lubricant, on the outer
R seal assembly (3). Install the seal assembly
R around the outer end of the driveshaft and attach
R it with four bolts (1). Torque the bolts to 25 -
R 30 lb-in. Safety the bolts with lockwire.

R (e) When the assembly is completed, use Argo-Tech tool
R 207954 Crank to turn the pump through the shaft.
R Make sure that the shaft turns freely and does not
R rub. If there is too much friction, or if the
R shaft rubs against adjacent parts, send the pump
R to overhaul.

C. Postrequisites

(1) Install the fuel pump and fuel control package by Section 73-11-01, Removal/Installation-00 (Task 73-11-01-450-001).

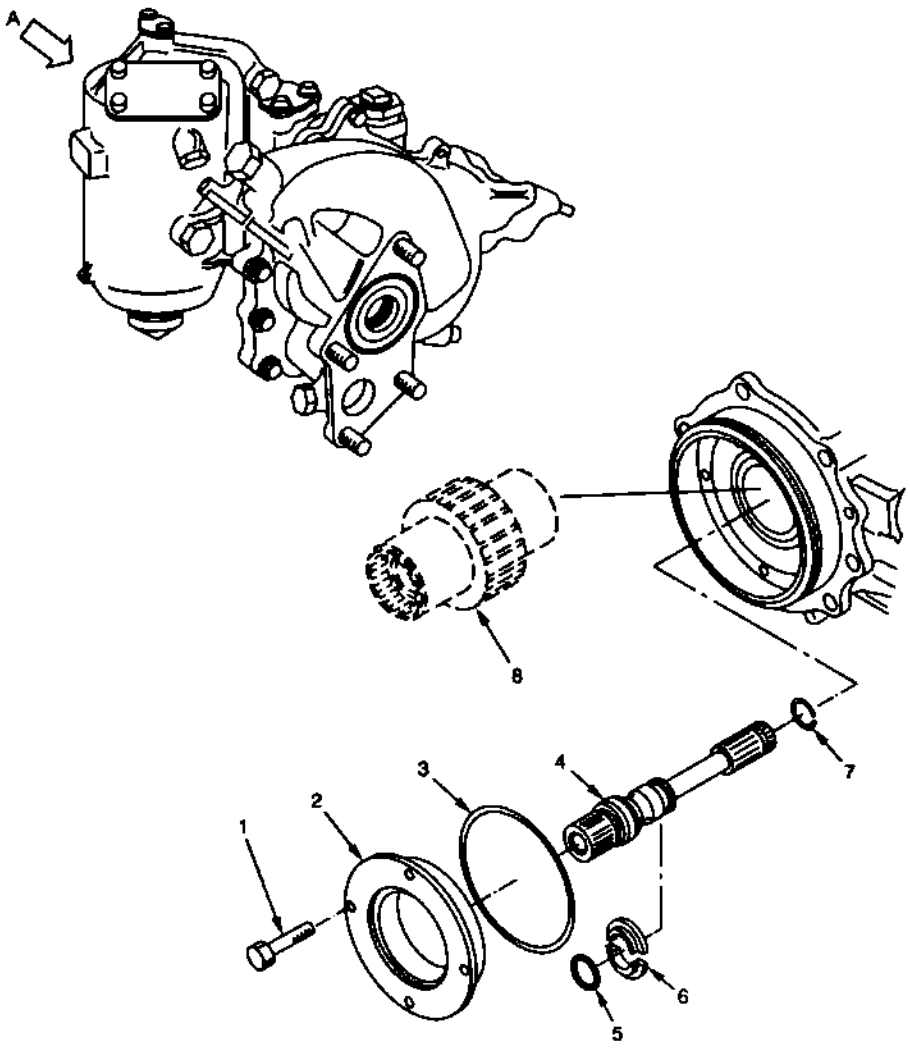


R Fuel Pump Driveshaft
R Removal/Installation (Pre SB 6439)
Figure 602 (Sheet 1)
(Task 73-11-01-210-002)

1. Bolt (4)
2. Washer (4)
3. Seal Assembly
4. Packing
5. Driveshaft
6. Rotating Seal Ring
7. Packing
8. Washer
9. Split Collar
10. Retaining Ring
11. Internal Driver Gear

Key to Figure 602 (Sheet 1)

R
R



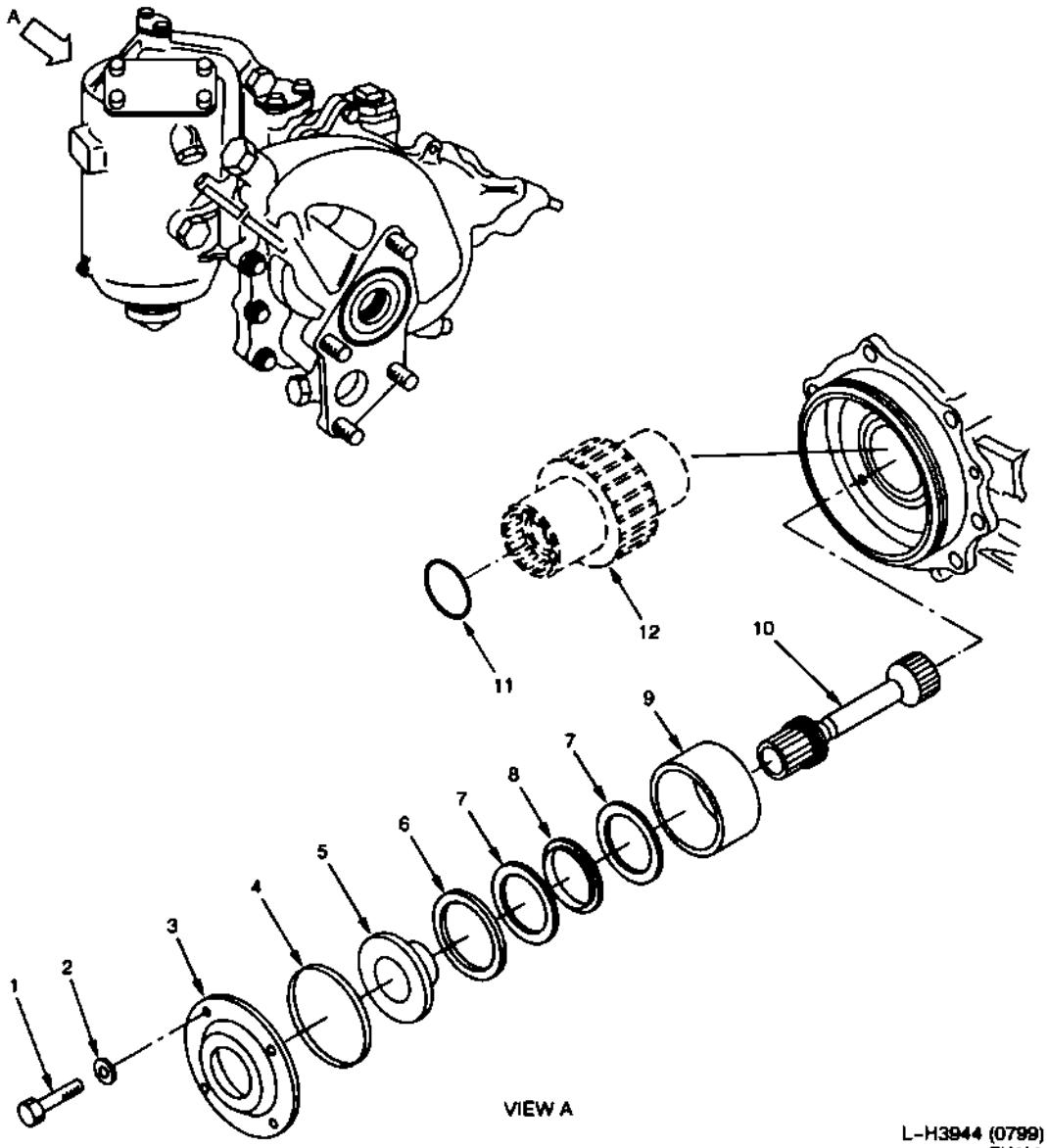
VIEW A

L-H8467 (0709)
PW V

Fuel Pump Driveshaft
Removal/Installation
(Post SB 6439)
Figure 602 (Sheet 2)
(Task 73-11-01-210-002)

R 1. Bolt (4)
R 2. Seal Assembly
R 3. Packing
R 4. Driveshaft
R 5. Retaining Ring
R 6 Split Collar
R 7. Retaining Ring
R 8. Internal Driver Gear

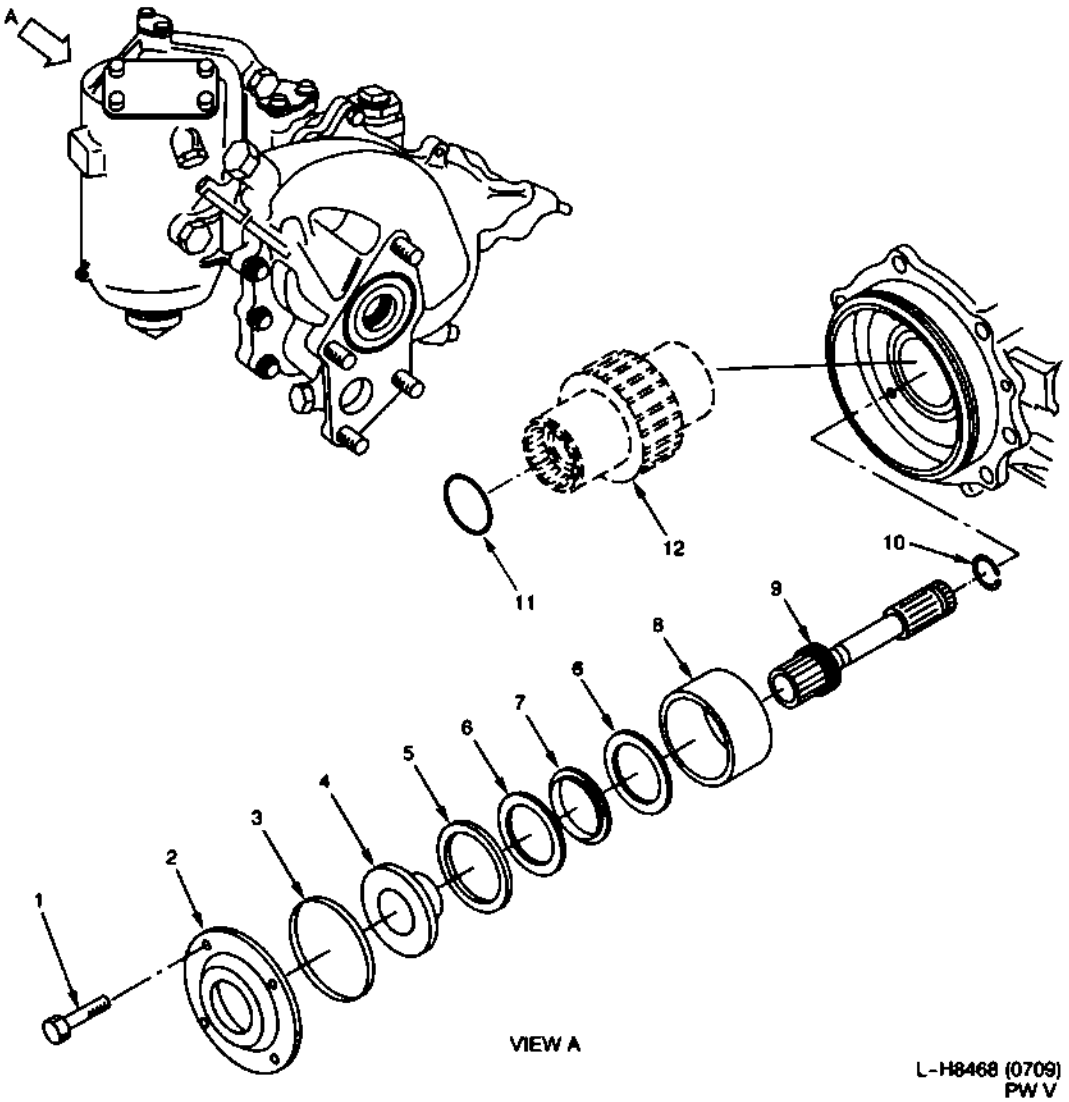
R Key to Figure 602 (Sheet 2)



R Fuel Pump Driveshaft
R Removal/Installation (Pre SB 4939)
Figure 603 (Sheet 1)
(Task 73-11-01-210-002)

1. Bolt (4)
2. Washer (4)
3. Seal Assembly
4. Packing
5. Rotating Seal Ring
6. Shim (As Necessary)
7. Urethane Washer (Inner and Outer)
8. Spring
9. Retaining Washer
10. Driveshaft
11. Packing
12. Internal Driver Gear

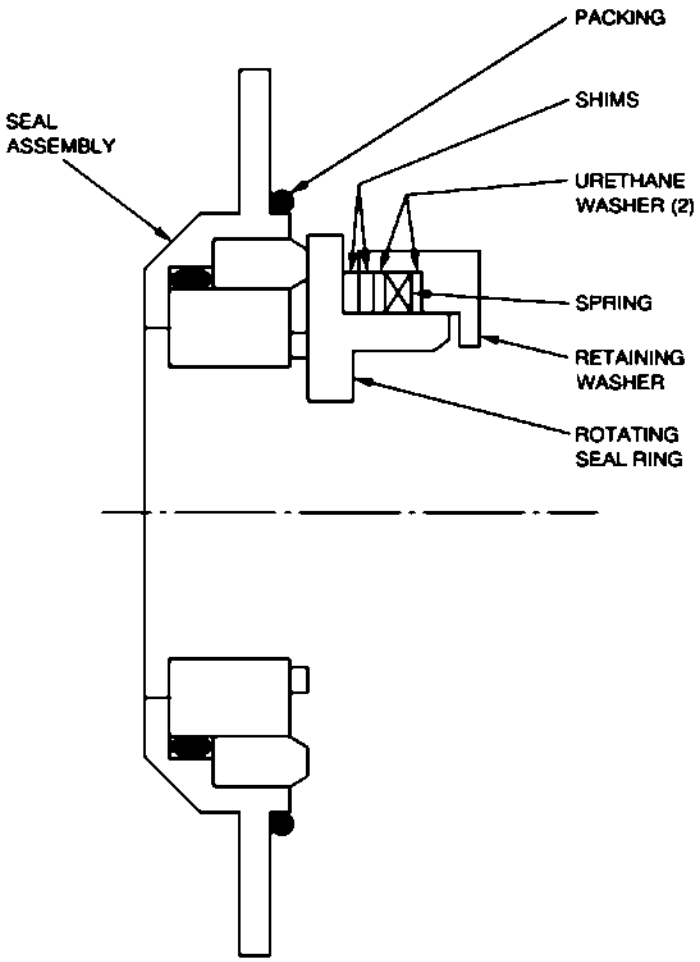
Key to Figure 603 (Sheet 1)



Fuel Pump Driveshaft
Removal/Installation
(Post SB 6439)
Figure 603 (Sheet 2)
(Task 73-11-01-210-002)

R 1. Bolt (4)
R 2. Seal Assembly
R 3. Packing
R 4. Rotating Seal Ring
R 5. Shim (As Necessary)
R 6. Urethane Washer (Inner and Outer)
R 7. Spring
R 8. Retaining Washer
R 9. Driveshaft
R 10. Retaining Ring
R 11. Packing
R 12. Internal Driver Gear

R Key to Figure 603 (Sheet 2)



L-H3946 (0799)
PW V

Fuel Pump Driveshaft
Removal/Installation
Figure 603 (Sheet 3)
(Task 73-11-01-210-002)

FUEL PRESSURIZING AND DUMP VALVE - DESCRIPTION-00

Task 73-12-01-990-001:

1. Description

See Figure 1.

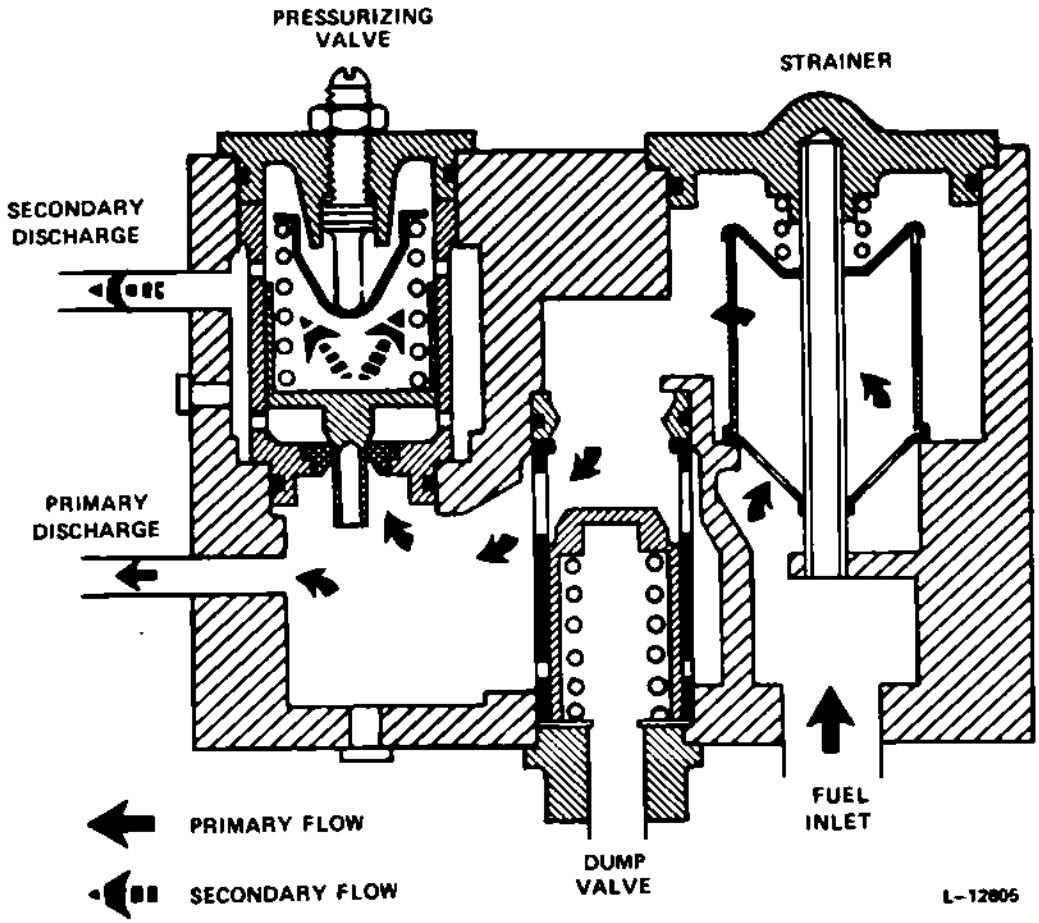
A. The fuel pressurizing and dump valve is located downstream of the fuel control and is connected to the primary and secondary fuel manifolds to which it discharges its fuel. The essential parts of the fuel pressurizing and dump valve include a 200 mesh fuel inlet screen, a dump (manifold drain) valve, and a pressurizing (flow-dividing) valve.

B. The fuel pressurizing and dump valve is located on the lower left side of the fan discharge diffuser section outer duct. Locknuts secure the valve to three studs in the duct.

Task 73-12-01-990-002:

2. Operation

A. Fuel entering the fuel pressurizing and dump valve is filtered by the 200 mesh fuel inlet screen. The screen unseats at approximately 11.7 psi in the event of clogging, and permits bypass fuel flow. As the fuel pressure in the strainer chamber increases, spring pressure behind the dump valve is overcome and the valve is forced into the closed position. This movement of the dump valve exposes the port through which fuel then flows to the primary chamber of the pressurizing valve. The entire flow then discharges to the primary manifold. When primary chamber fuel pressure surrounding the pintle of the pressurizing valve becomes sufficient to overcome the force of the valve spring, the valve unseats, and fuel flows into the secondary chamber. Flow from the secondary chamber then discharges to the secondary manifold. The contour of the pintle is designed to divide the primary and secondary flows to give satisfactory nozzle spray characteristics at all fuel flow conditions.



Fuel Pressurizing and
Dump Valve Schematic
Figure 001
(Task 73-12-01-990-002)

FUEL PRESSURIZING AND DUMP VALVE - REMOVAL/INSTALLATION-00

Task 73-12-01-450-001:

1. Removal/Installation of Fuel Pressurizing and Dump Valve

A. Removal

CAUTION: WHEN REMOVING FUEL OIL COOLER TO PRESSURIZING AND DUMP VALVE FUEL TUBE, DO NOT APPLY EXCESSIVE FORCE TO TUBE, TO PREVENT DAMAGING TUBE. MOVE TUBE REARWARD TO ITS MAXIMUM ENGAGEMENT IN PRESSURIZING AND DUMP VALVE, THEN REMOVE FORWARD END OF TUBE FROM FUEL OIL COOLER WITHOUT EXCESSIVE FORCE. IF EXCESSIVE FORCE IS NEEDED FOR TUBE REMOVAL, REMOVE PRESSURIZING AND DUMP VALVE, THEN REMOVE TUBE.

(1) Remove external lines connected to fuel pressurizing and dump valve.

NOTE: Current connection of fuel oil cooler to pressurizing and dump valve tube employs stop nut and key washer securing tube to coupling nut. Disconnect stop nut from coupling nut before disconnecting coupling nut. Discard stop nut keywasher as well as coupling nut packing and retainer. See Figure 401.

(2) Loosen and remove bolts securing dump valve to engine. Remove valve. See Figure 402.

B. Installation

(1) Position dump valve on engine and secure it with washers and bolts. See Figure 402.

NOTE: Use washers and locknuts for stud type installations. Pressurizing and dump valve must be assembled with all necessary fittings as shown in Figure 402. Install adapters, plug and reducer with packings lubricated with petrolatum.

CAUTION: WHEN INSTALLING FUEL OIL COOLER TO PRESSURIZING AND DUMP VALVE FUEL TUBE, DO NOT APPLY EXCESSIVE FORCE TO TUBE, TO PREVENT DAMAGING TUBE. MOVE TUBE REARWARD TO ITS MAXIMUM ENGAGEMENT IN PRESSURIZING AND DUMP VALVE, THEN INSTALL FORWARD END OF TUBE INTO FUEL OIL COOLER WITHOUT EXCESSIVE

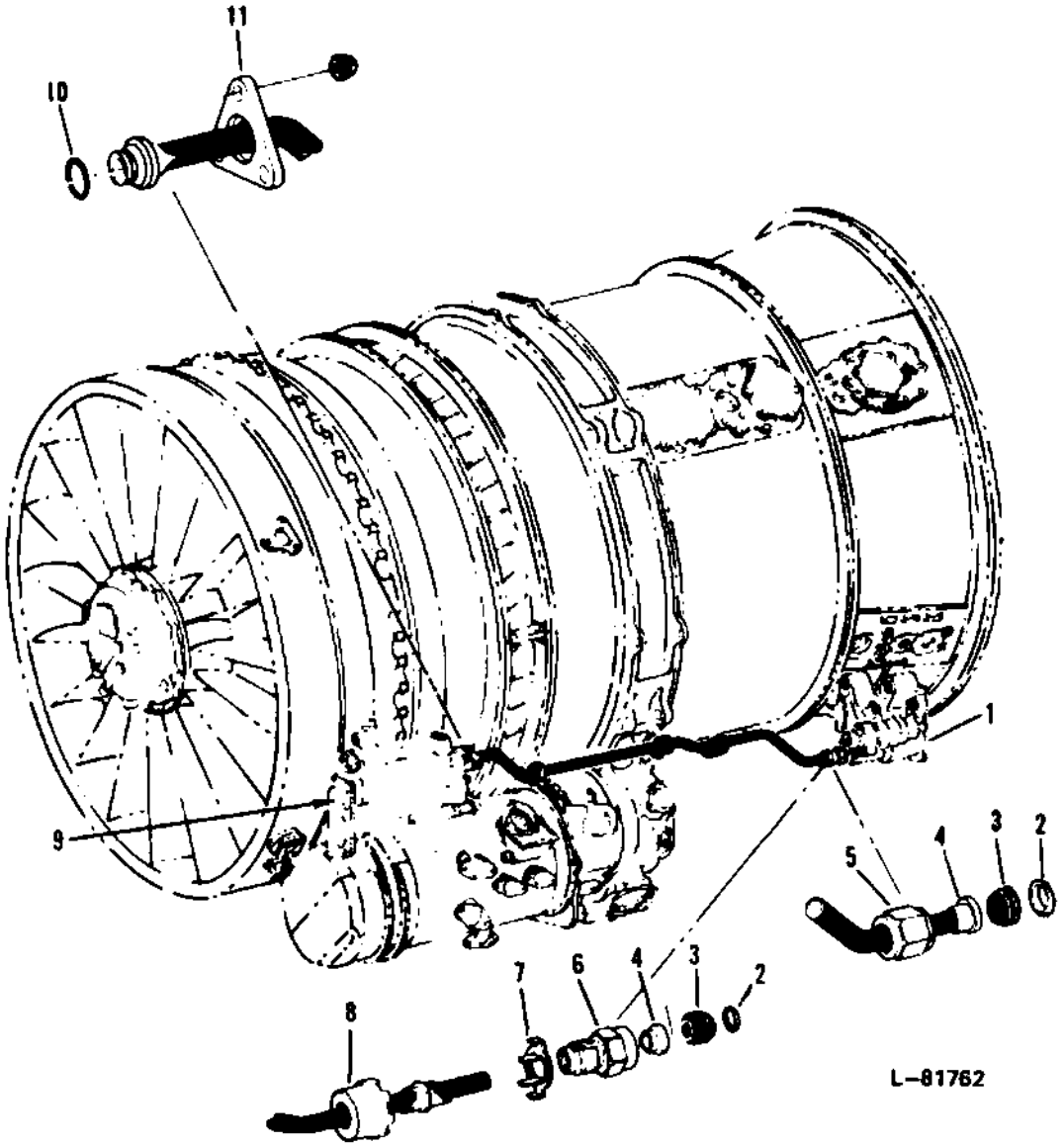
FORCE. IF EXCESSIVE FORCE IS NEEDED FOR TUBE INSTALLATION, REMOVE PRESSURIZING AND DUMP VALVE, INSTALL TUBE, AND REINSTALL VALVE.

(2) Install and secure external lines connected to valve.

NOTE: Current connection of fuel oil cooler to pressurizing and dump valve tube employs stop nut and key washer securing tube to coupling nut. After torquing coupling nut thread stop nut onto coupling nut handtight. Back off to next locking position and bend tabs of new key washer. See Chapter/Section 70-00-00, Standard Practices-00.

Task 73-12-01-450-002:

2. Removal/Installation Of Fuel Pressurizing And Dump Valve Strainer (Refer to Chapter/Section 73-12-05, (Removal/ Installation-00



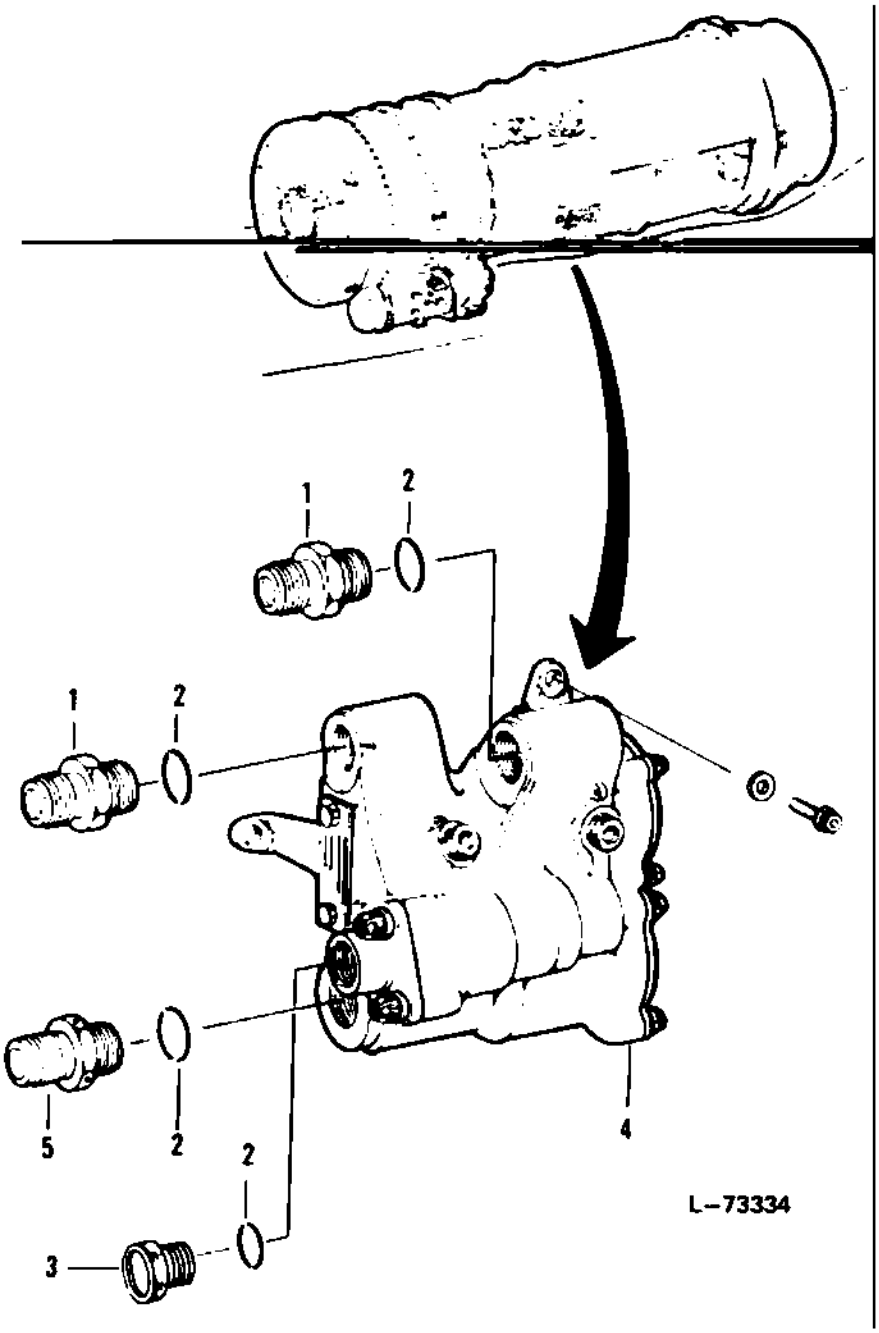
Pressurizing And Dump Valve
Tube Removal/Installation
Figure 401
(Task 73-12-01-450-002)

FUEL PRESSURIZING AND DUMP VALVE - REMOVAL/INSTALLATION-00

1. Pressurizing And Dump Valve
2. Retainer
3. Packing
4. Ferrule
5. Coupling Nut
6. Coupling Nut
7. Key Washer
8. Stop Nut
9. Oil Cooler
10. Packing
11. Retaining Plate

Key to Figure 401

FUEL PRESSURIZING AND DUMP VALVE - REMOVAL/INSTALLATION-00



1. Adapter
2. Packing
3. Plug
4. Pressurizing And Dump Valve
5. Reducer

Pressurizing And Dump
Valve Removal/Installation
Figure 402
(Task 73-12-01-450-002)

FUEL PRESSURIZING AND DUMP VALVE - CLEANING/PAINTING-00

Task 73-12-01-110-001:

1. Cleaning Of Fuel Pressurizing And Dump Valve Strainer (Refer To Chapter/Section 73-12-05, Cleaning/Painting)

FUEL PRESSURIZING AND DUMP VALVE STRAINER - REMOVAL/INSTALLATION-00

Task 73-12-05-450-001:

1. Removal/Installation Of Fuel Pressurizing And Dump Valve Strainer

See Figure 401.

A. Removal

(1) Remove locknuts and washers securing strainer cover to housing.

(2) Remove assembled cover and strainer.

(3) Remove cotter pin and retaining collar to free strainer and spring from rod.

B. Assembly

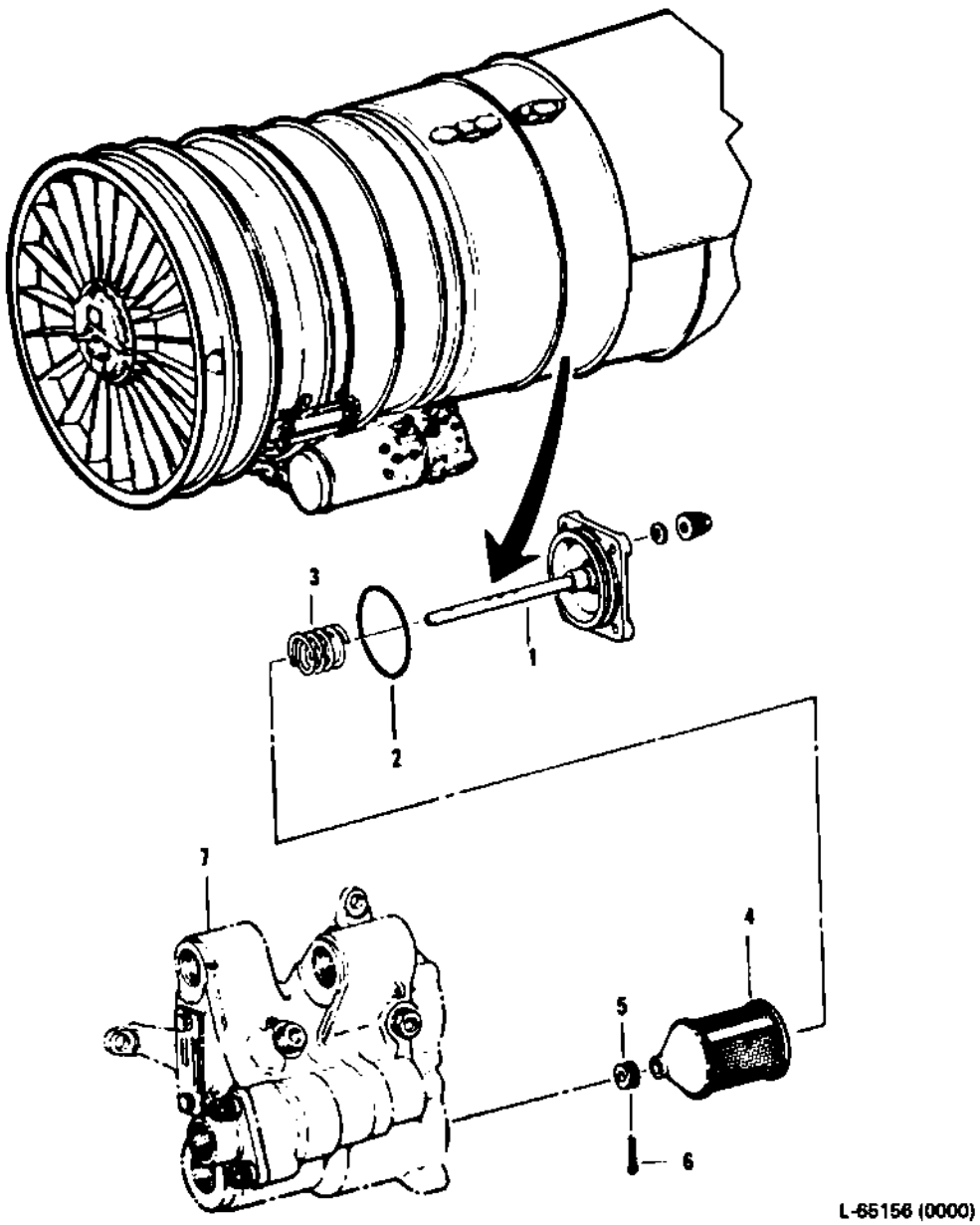
(1) Place spring and strainer in position on cover and rod assembly and secure with retaining collar and cotter pin.

(2) Lubricate new packing with a thin layer of PWA 36500 Assembly Fluid and install in cover groove.

(3) Position assembled cover and strainer in housing, locating end of rod in guide in strainer chamber.

(4) Secure cover with washers and locknuts.

FUEL PRESSURIZING AND DUMP VALVE STRAINER - REMOVAL/INSTALLATION-00



Fuel Pressurizing And Dump Valve
Strainer Removal/Installation
Figure 401
(Task 73-12-05-450-001)

FUEL PRESSURIZING AND DUMP VALVE STRAINER - REMOVAL/INSTALLATION-00

1. Strainer Rod
2. Preformed Packing
3. Spring
4. Strainer Element
5. Retaining Collar
6. Cotter Pin
7. Fuel Pressurizing And Dump Valve

Key to Figure 401

FUEL PRESSURIZING AND DUMP VALVE STRAINER - CLEANING/PAINTING-00

Task 73-12-05-110-001:

1. Cleaning of Fuel Pressurizing and Dump Valve Strainer

A. Procedure

R (1) Clean the fuel pressurizing and dump valve strainer and
R all other related metal parts as follows.

R (a) Strainer element

R 1 Flush the strainer in PMC 9001 Stoddard
R Solvent. Refer to 70-30-00, Standard
R Practices-01, P11-027.

R 2 Clean the strainer by SPOP 209 (Task
R 70-00-00-100-003). Refer to 70-00-00
R Cleaning/Painting-03 in Standard Practices.

R (b) Related metal valve parts

R 1 Clean the parts in PMC 9001 Stoddard Solvent.
R Refer to 70-30-00, Standard Practices-01,
R P11-027.

R 2 Clean the parts by SPOP 209 (Task
R 70-00-00-100-003). Refer to 70-00-00
R Cleaning/Painting-03 in Standard Practices.

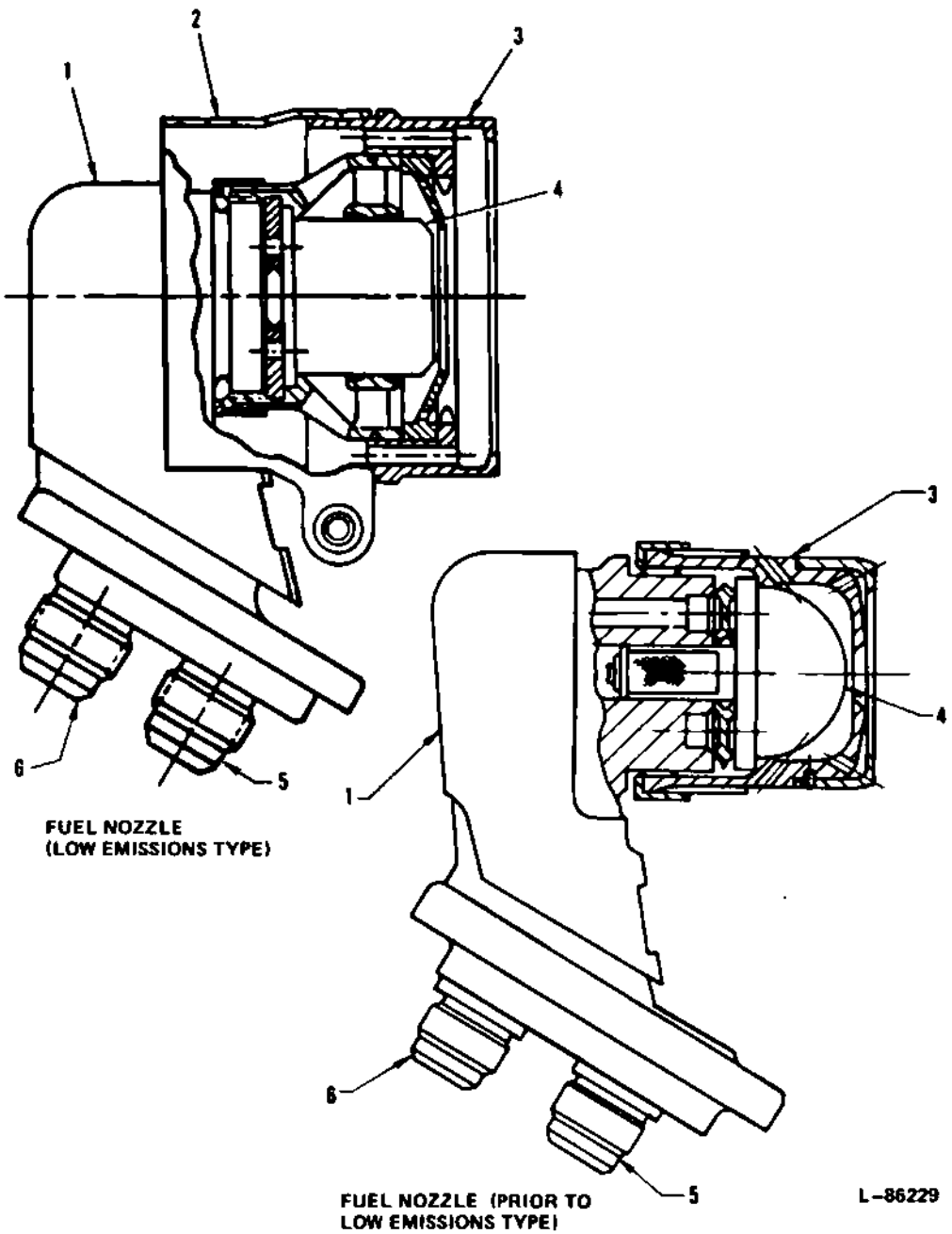
FUEL NOZZLE AND SUPPORT - DESCRIPTION-00

Task 73-13-01-990-002:

1. Description and Operation of Fuel Nozzle and Support Assemblies

See Figure 1.

A. There are nine fuel nozzle and support assemblies. Fuel for each nozzle passes from the manifold through the support. The nozzle and support assemblies are positioned inside the front of the diffuser case with each nozzle facing rearward into its combustion chamber.



Fuel Nozzle and Support Assembly
Figure 001
(Task 73-13-01-990-002)

FUEL NOZZLE AND SUPPORT - DESCRIPTION-00

1. Fuel Nozzle Support
2. Fuel Nozzle Nut Scoop
3. Fuel Nozzle Nut
4. Fuel Nozzle
5. Primary Fuel Connector
6. Secondary Fuel Connector

Key to Figure 001

FUEL NOZZLE AND SUPPORT - REMOVAL/INSTALLATION-00

Task 73-13-01-430-001:

1. Removal/Installation of Fuel Nozzle and Support Assemblies

A. Removal

(1) Remove combustion section fan ducts. (See Section 72-40-00, Removal/Installation-00).

(2) Remove combustion chambers (as required). (See Section 72-40-00, Removal/Installation-00).

(3) Remove primary and secondary fuel supply manifolds.

(a) Remove supporting clips, then disconnect primary and secondary fuel supply manifolds from pressurizing and dump valve and at fuel inlet tubes (five and seven o'clock positions). Remove supply manifolds from engine.

(4) Disassemble and remove rear compressor fan duct rear fairing assemblies from approximate ten and two o'clock positions of fan discharge duct by removing brace from each, then unfastening hinge pins and bolts and nuts holding them to diffuser outer duct.

(5) Remove No. 4 bearing tubes fairing.

(a) Reach inside duct (where three tubes enter, lower left) and remove two screws from front of No. 4 bearing upper and lower fairing halves.

(b) Remove bolts holding duct halves to outer duct, then separate and remove them from duct.

NOTE: The two duct halves have screws and an interlock at front. Upper half hooks into lower half and hook must be disengaged to separate two halves.

(6) Remove diffuser fan duct strap (if so equipped).

(a) Unfasten screws and remove strap from around diffuser case rear flange.

(7) Unfasten screws securing diffuser inner fan duct segments together and screws securing duct to forward flange brackets. Position fan duct segments outward as far as possible to gain access to fuel manifold nuts and support assembly bolts.

(8) Remove conical seat system as follows:

(a) Unfasten coupling nuts at each nozzle location to be replaced (left and/or right side as required).

(b) Unbolt and remove nozzle and support assemblies from rear surface of diffuser case.

NOTE: If fuel manifolds incorporate transfer tubes inside each fuel nozzle connection (Reference SB 4484), remove these transfer tubes (from either manifold coupling or fuel nozzle connector) while removing each nozzle.

(9) Remove chevron seal system as follows:

(a) Remove bolts securing fuel nozzle and support assemblies to diffuser case as required and remove support assemblies.

B. Installation
See Figures 401 thru 404.

(1) Install conical seat system as follows:

(a) Install fuel nozzle and support assemblies, with gasket under base of each support. Secure with brackets and bolts, fingertight.

NOTE: See Figure 401 for the different configurations of fuel nozzle, diffuser case, and gasket.

(b) If fuel manifold incorporates transfer tube at each fuel nozzle coupling (Reference SB 4484), install two new packings coated with PWA 36500 Assembly Fluid on each transfer tube and install transfer tube in each fuel nozzle coupling on manifold.

CAUTION: CONNECTOR THREADS AND COUPLING NUT THRUSTWIRE MUST BE LUBRICATED WITH ENGINE OIL TO OBTAIN PROPER TORQUE. COAT CONICAL GASKETS WITH OIL TO ENSURE THAT

THEY REMAIN IN PROPER POSITION DURING ASSEMBLY.

(c) With new conical gaskets on each fuel nozzle connector (primary and secondary), install manifold coupling nuts onto support connectors. Tighten coupling nuts fingertight.

NOTE: If it is not possible to tighten nuts by hand, or all fuel nozzle and support assemblies are being replaced (left and/or right side) loosen all couplings nuts, bolts securing fuel nozzle and support assemblies, fairings and fuel manifold retaining clamps and clips to allow free movement of manifolds.

CAUTION: REPLACE ALL GASKETS BETWEEN FUEL NOZZLE AND SUPPORT ASSEMBLIES, CONICAL GASKETS ON EACH FUEL NOZZLE CONNECTOR, AND TRANSFER TUBE PACKINGS (SB 4484 TYPE) AT ALL LOOSENED LOCATIONS.

(d) With fuel nozzle and support retaining bolts loose, and new conical gaskets installed, check alignment of manifolds and tighten all coupling nuts by hand, starting near center of manifolds and working toward ends. If it is not possible to tighten one or more coupling nuts by hand, remove manifold and inspect for proper alignment.

NOTE: Engine must be removed from airframe to remove manifolds. Manifolds should be sent to accessory overhaul facility and inspected per Section 73-15-1 in JT8D Accessory Components Overhaul Manual.

(e) Secure fuel nozzles and manifolds not incorporating coupling transfer tubes (prior to SB 4484) as follows: 1 Starting at center of manifolds, torque tube coupling nuts 270 - 300 pound-inches, using PWA 33523 Wrench.

NOTE: PWA wrench extends effective length of torque wrench. Adjust observed torque reading to allow for extension. See Chapter/Section 70-00-00, Standard Practices-00. 2 Wait five minutes; then, without loosening, torque all coupling nuts

again 270 - 300 pound-inches, in same sequence as before. If any nuts were not up to 270 pound-inches, wait five minutes and repeat torquing procedure. This should be repeated until all coupling nuts hold 270 pound-inches torque.

NOTE: If after four torquing procedures, any nuts still show torque relaxation, remove manifold and inspect for proper alignment. (See Note after step 1.B.(d) above.) 3 Tighten and torque all bolts securing fuel nozzle and support assemblies 65 - 85 pound-inches. 4 Tighten all previously loosened clips, clamps and fairings. Secure fuel manifold loop clamp brackets to diffuser case rear flange using workbolts and nuts. 5 Recheck all tube coupling nuts to ensure they are still 270 pound-inches. If not, remove manifold and inspect for proper alignment. (See Note after step 1.B.(d) above.)

(f) Secure fuel nozzles and manifolds incorporating coupling transfer tubes (Reference SB 4484) as follows: 1 With coupling nuts fingertight, pressure test assembled fuel nozzle and support and fuel manifold as directed in Adjustment/Test. If no leaks are found, torque coupling nuts per step 2. 2 Starting at center of manifold, torque fuel manifold coupling nuts to 350 - 400 pound-inches. On secondary system coupling nuts (positioned forward and inward in relation to diffuser case surface), use PWA 46171 Wrench and PWA 46170 Wrench. On primary-system coupling nuts (rearward and outward in manifold assembly), and on coupling nut in secondary system which is close to bleed manifold at ten o'clock position, use standard 7/8 inch crowsfoot wrench or PWA 46170 Wrench.

NOTE: PWA wrench or standard crowsfoot wrench will extend effective length of torque wrench. PWA 46171 Wrench has effective length of 1.42 inch. Adjust observed torque reading to allow for extension. See Chapter/Section 70-00-00, Standard Practices-00. When using PWA 46171 Wrench one bleed valve and both fuel

manifold fairings must be removed. 3 After tightening last coupling nut on manifold, check coupling nuts for relaxation of torque (without loosening nuts), following same sequence used for original torquing. If any nut on manifold does not hold torque, repeat torque procedure (without loosening nuts) until all nuts hold torque. If, after four torquing procedures, nuts still fail to hold torque, fuel manifold must be removed and inspected. See Note after step 1.B.(d), above. 4 Torque fuel nozzle and support attaching bolts to 65 - 85 pound-inches. 5 Tighten all previously loosened clips, clamps, and fairings. Secure fuel manifold loop clamp brackets to diffuser case rear flange using workbolts and nuts.

(g) Lockwire coupling nuts and fuel nozzle and support assembly retaining bolts.

(h) Remove workbolts and nuts securing loop clamp brackets to diffuser case rear flange.

(2) Install chevron seal system as follows:

(a) Before assembling for pressure test, dimensionally check fuel nozzle supports to check for adequate chevron seal compression between fuel manifold and fuel nozzle support as follows:

1 Install new oval gaskets onto base of fuel nozzle supports.

2 Temporarily install fuel nozzle and support assemblies into diffuser case bosses.

CAUTION: USE WASHERS ON BOLTS TO REDUCE POSSIBILITY OF MARRING DIFFUSER CASE MANIFOLD MOUNTING FLANGE SURFACE.

3 Install and torque bolts to 75 - 85 pound-inches.

4 Measure distance from fuel manifold mounting boss (on diffuser case OD) to sealing surface of nozzle support. See Figure 402.For engines with spacer plate, the above distance must not exceed 0.100 inch. For engines without spacer plate, sealing surface of nozzle can protrude beyond surface of diffuser case but must not be below flush.

CAUTION: OVAL GASKETS USED ON FUEL NOZZLE AND SUPPORT ASSEMBLIES DURING ABOVE DIMENSIONAL CHECKS MUST BE USED DURING FOLLOWING ASSEMBLY PROCEDURES.

5 Remove bolts securing fuel nozzle supports to diffuser case.

(b) Install replacement fuel nozzle and support assemblies at diffuser case mount pad from rear of case.

1 Install nozzle support spacer plate (if so equipped) and oval gasket in base of each nozzle support.

(c) For engines not incorporating SB 3226, position double angle fan duct bracket assembly under manifold and support securing bolts. Position single nut fan duct bracket assemblies at remaining locations. Secure nozzles, manifolds, and brackets to case with bolts at each nozzle location, boltheads outside of case.

(d) Install right fuel manifold, nozzle and support assemblies, and brackets in same manner as for left. (Position double angle fan duct bracket assembly at No. 5 nozzle.)

CAUTION: DO NOT EXCEED 85 POUND-INCHES OF TORQUE ON FUEL MANIFOLD MOUNTING BOLTS.

(e) Torque fuel manifold mounting bolts on replacement fuel nozzle and support assemblies, to 65 - 85 pound-inches and lockwire.

(3) Pressure test fuel system. (See Section 73-13-01, Adjustment/ Test-00).

NOTE: Conical-seat fuel systems incorporating transfer tubes in fuel nozzle connections (Reference SB 4484) do not require pressure testing after coupling nuts have been torqued.

(4) Install combustion chambers. (See Chapter/Section 72-40-00, Removal/Installation-00).

(5) Position diffuser inner fan duct segments inward and secure to diffuser front flange gangnuts and to each other (top and bottom) with washers and screws. Secure rear flange to brackets.

(6) Install diffuser fan duct strap (if so equipped) around case rear flange. Position ends of strap in front of left igniter plug boss. Secure with screws and tighten.

(7) Install No. 4 bearing tubes fairing.

(a) Install No. 4 bearing tubes upper and lower fairing halves in fan discharge duct around three tubes. Secure them together at front with two washers and screws. Secure them to outer duct with washers, brackets, and bolts.

(8) Install rear compressor fan duct rear fairing assemblies.

(a) Install left and right rear fairing assemblies at approximate two o'clock position, between inner and outer fan ducts, with hinged ends toward rear of engine, and inserting forward ends into front compressor fairings.

(b) Position brace between fairings with flat face toward inner duct, align holes, and secure with screw, and screws and nuts, fingertight, screw heads outside fairings.

(c) For engines equipped with bolted fairing configuration, install bolt into hinged end of segments. Secure at inner end with self-locking nuts. Check axial gap. Gap must be 0.000 - 0.005 inch for JT8D-1,-1A,-1B,-7,-7A,-7B,-9,-9A and -11 engines and 0.005 - 0.015 inch for JT8D-15,-17, and -17R engines.

(d) For engines equipped with pin and washer configuration, install hinge pin into hinged end of segments and secure with washer and lockwire at inner end. Seal lockwire with RTV 157 or 159 sealant.

(e) Align fairing lug holes with outer duct holes and secure with bolts (heads outward), washers, and nuts, fingertight. Torque screws securing brace.

(f) Torque bolts securing fairings.

(g) Install other left and right rear fairing assemblies at ten o'clock position in same manner as for two o'clock position.

(9) Install primary fuel supply manifold (chevron seal system).

(a) Position new keywasher and coupling nut on middle tube of primary fuel manifold.

CAUTION: IF RETAINER IS NOT USED, PACKING CAN PROTRUDE BETWEEN TUBE AND CONNECTOR AND PIECES OF RUBBER CAN ENTER SYSTEM.

(b) Install ferrule, new packing (lubricated with a thin layer of PWA 36500 Assembly Fluid) and retainer over middle tube end (mating with left fuel inlet boss). If manifold assembly has stamped metal ferrule at this location, install extra retainer in hollow of ferrule. Subsequent assemblies use only one retainer.

(c) Install new packings (lubricated with a thin layer of PWA 36500 Assembly Fluid) and retainers on ferrule end (right) and elbow end of manifold.

(d) Position primary manifold on engine and secure nuts at both fuel inlet tubes and at pressurizing and dump valve. Tighten nuts to recommended torque and lockwire.

(e) Tighten stop nut fingertight against stop on tube. Back off one-half turn maximum to next slot to align with lock tabs. Bend tabs of key washer and securely crimp tabs over stop nut flange.

(f) Check thread engagement between stop nut and coupling nut. This must be such that a No. 60 wire will not pass through 0.063 inch diameter stop nut holes.

(g) Secure manifold to bracket with clip.

(10) Install secondary fuel supply manifold (chevron seal system).

(a) Prepare secondary manifold (using proper secondary manifold parts) and install in the same manner as primary fuel supply manifold.

(11) Install primary fuel supply manifold (conical-seat system).

CAUTION: IF RETAINER IS NOT USED, PACKING CAN PROTRUDE BETWEEN TUBE AND CONNECTOR AND PIECES OF RUBBER MAY ENTER SYSTEM.

(a) Install new packings (lubricated with a thin layer of PWA 36500 Assembly Fluid) and retainers on ferrule ends and elbow end of manifold.

(b) Position primary manifold on engine and secure nuts at both fuel manifold inlet ends and at pressurizing and dump valve. Tighten nut to recommended torque and lockwire.

(c) Secure primary manifold to bracket with clip.

(12) Install secondary fuel supply manifold (conical-seat only).

(a) Prepare secondary manifold and install in same manner as primary supply manifold.

(13) Install combustion section fan ducts. (See Section 72-40, Removal/Installation).

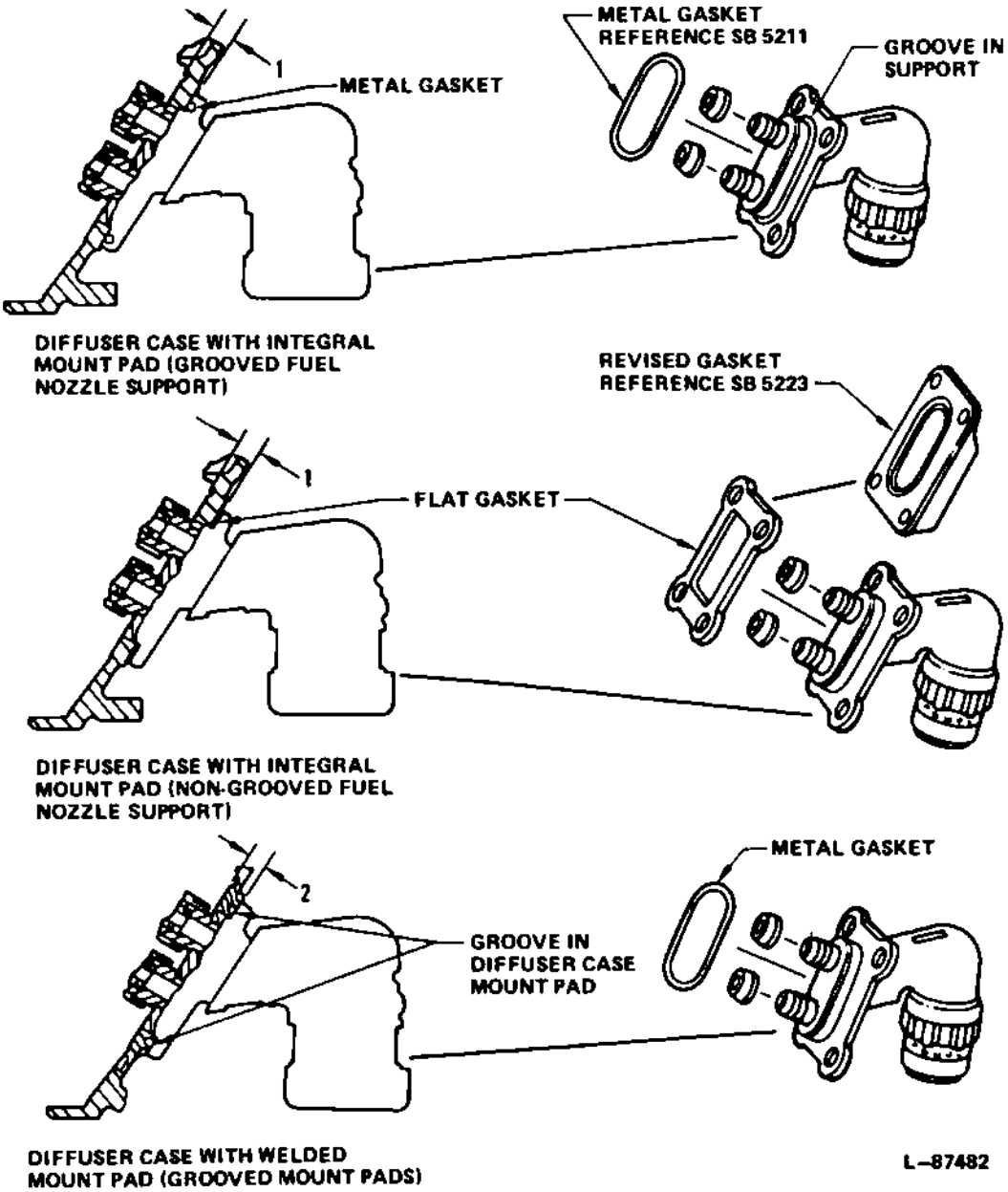
(14) Test engine per "Repair Test Reference Table", in Engine General - Adjustment/Test.

Task 73-13-01-990-003:

2. Tools And Equipment

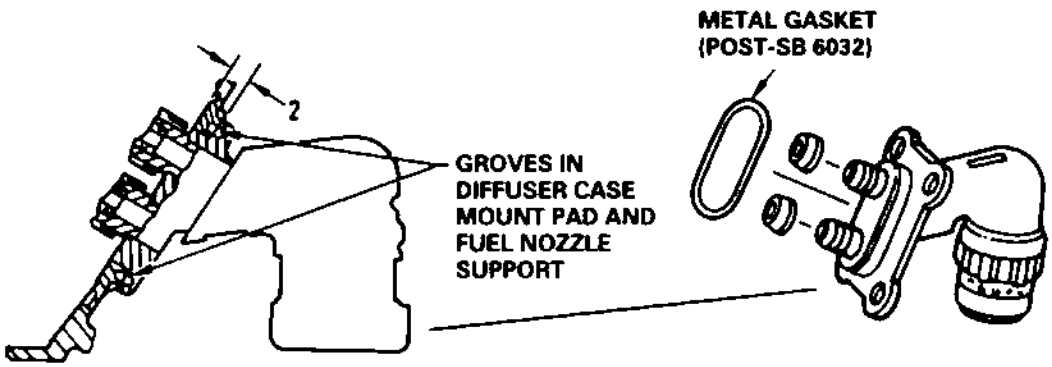
A. Special Tools

PWA 33523	Wrench (Pre SB 4484)
PWA 46170	Wrench (Post SB 4484)
PWA 46171	Wrench (Post SB 4484)



1. 0.190 Inch Nominal
2. 0.250 Inch Nominal

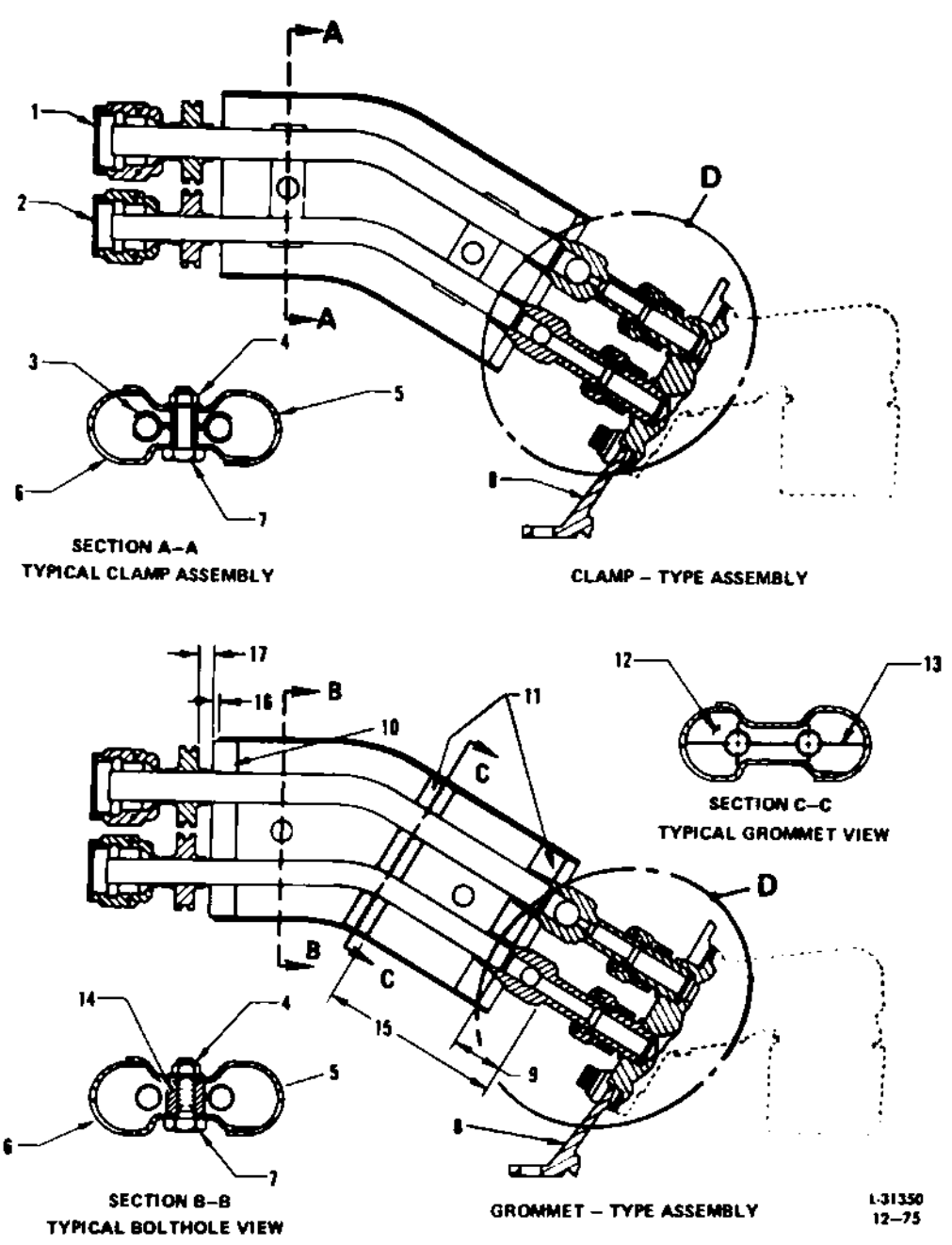
Fuel Nozzle Support And Diffuser
Case Mount Pad Configurations
Figure 401 (Sheet 1)
(Task 73-13-01-990-003)



VIEW D
DIFFUSER CASE WITH WELDED
MOUNT PAD (GROOVED MOUNT PADS)

L-H1211 (0000)

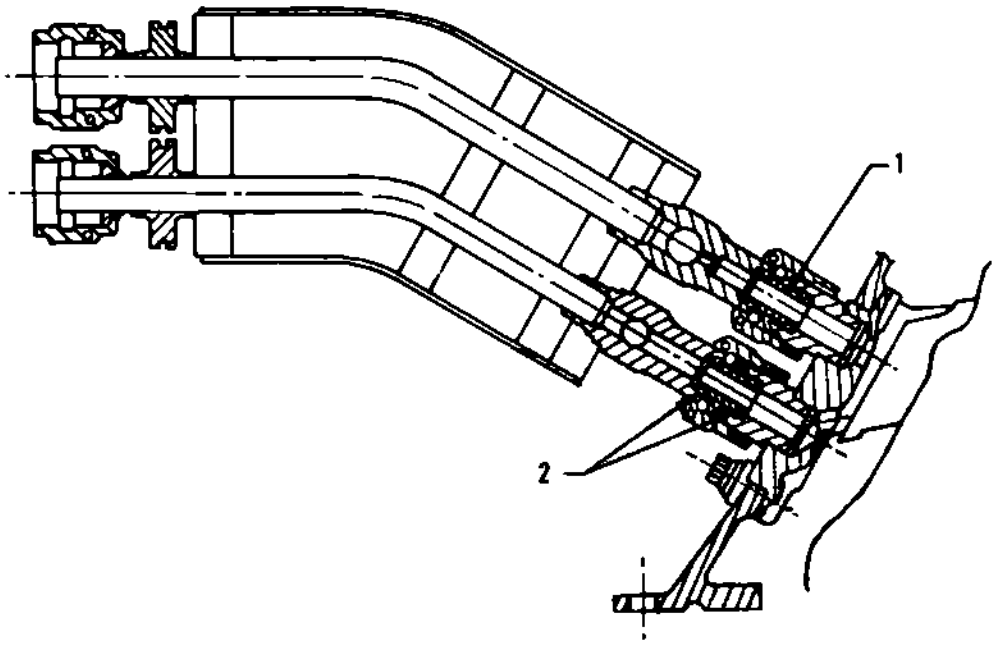
Fuel Nozzle Support And Diffuser
Case Mount Pad Configurations
Figure 401 (Sheet 2)
(Task 73-13-01-990-003)



Fuel Manifold Tube Assembly
Figure 402 (Sheet 1)
(Task 73-13-01-990-003)

1. Secondary Fuel Tube
2. Primary Fuel Tube
3. Fuel Manifold Clamp Half, PN 634988
4. Nut, PN 629168
5. Fairing Half, PN 629166
6. Fairing Half, PN 629167
7. Bolt, AN101112
8. Diffuser Case Rear Flange
9. 0.940 - 0.970 Inch
10. Grommet Halves, PN 702034
11. Grommet Halves, PN 702033
12. Typical Grommet Half
13. Adhesive, PN 671797
14. Spacer, PN 384836 and Rubber Chafing Guard PN 709642
15. 2.380 - 2.420 Inches
16. 0.030 - 0.050 Inches
17. 0.200 - 0.260 Inches

Key to Figure 402 (Sheet 1)

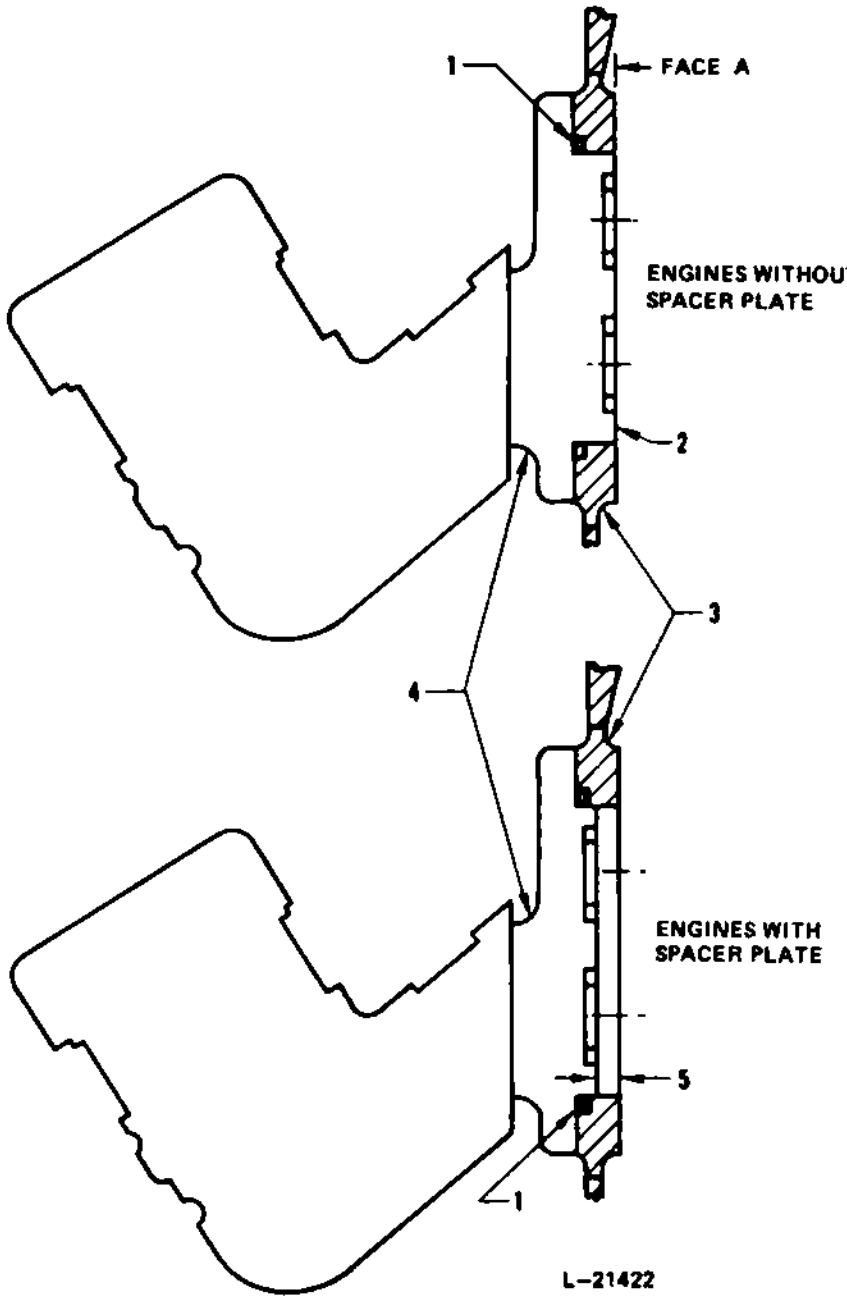


VIEW D

TRANSFER TUBE – TYPE ASSEMBLY

L–51921
12–75

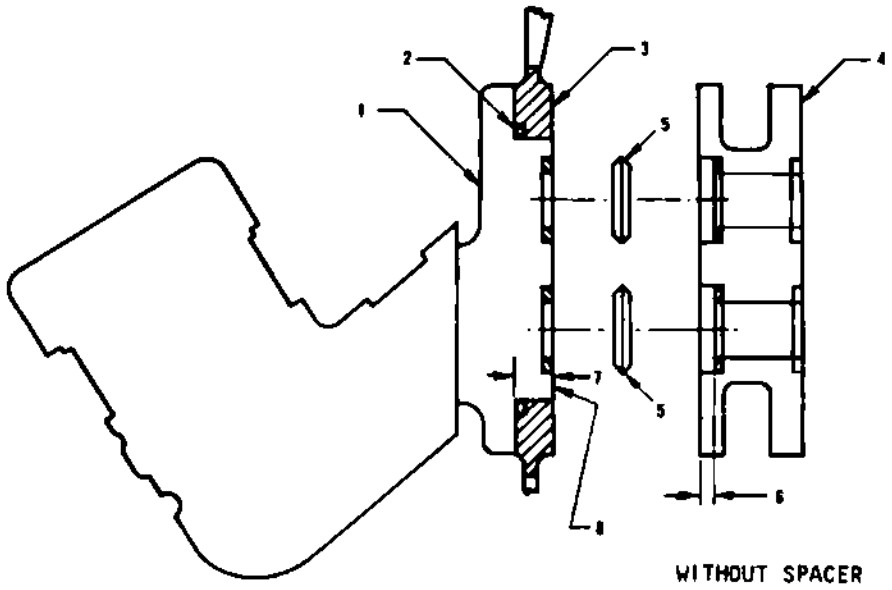
1. Transfer Tube (Typical, Primary Or Secondary System)
2. Preformed Packings (Two Per Transfer Tube)



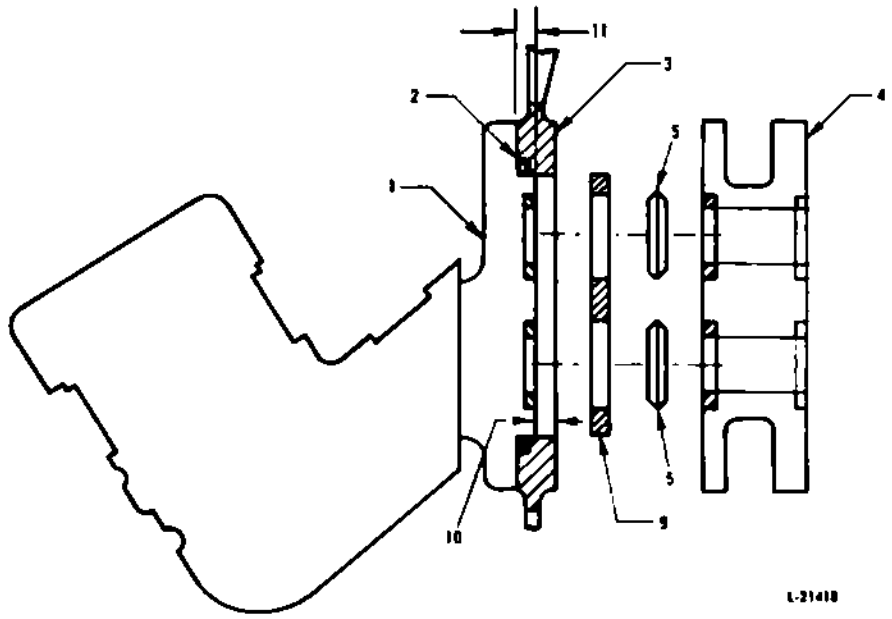
Dimensional Check To Ensure
Chevron Seal Compression
Figure 403
(Task 73-13-01-990-003)

1. Oval Gasket. Gasket Used For Compression Check Must Be Used At Final Assembly.
2. This Surface May Protrude Beyond Face A But Must Not Be Below Flush.
3. Diffuser Case Mounting Boss.
4. Fuel Nozzle and Support Assemblies.
5. This Dimension Must Not Exceed 0.100 Inch Maximum.

Key to Figure 403



WITHOUT SPACER



WITH SPACER

Fuel Nozzle and Support Assembly
Installation (Chevron Seals)
Figure 404
(Task 73-13-01-990-003)

1. Fuel Nozzle And Support Assembly.
2. Oval Gasket.
3. Diffuser Case Fuel Manifold.
4. Fuel Manifold.
5. Chevron Seals. See 72-40-00 Inspection/Check-00 Ref. No. 706 For Seal Free Height and Ref. No. 707 For Seal Pinch Fit.
6. Manifold Groove Depth. See Inspection/Check-00, Ref. 710.
7. Fuel Nozzle Support "Snout", For Engines Without Spacer Plate. See Inspection/Check-00, Ref. 711. (See Reference 708 For Thickness Of Diffuser Case Mount Pad).
8. See Figure 402 For Check Of Chevron Seal Compression.
9. Spacer Plate. See Inspection/Check-00 Ref. 710.
10. Distance From Fuel Manifold Mounting Boss On Diffuser Case OD To Sealing Surface Of Nozzle Support Must Not Exceed 0.100 Inch.
11. Fuel Nozzle Support "Snout", For Engines With Spacer Plate. See Inspection/Check-00 Ref. 709.

Key to Figure 404

Task 73-13-01-780-001:

1. Pressure Test Of Fuel Nozzles And/Or Fuel Manifold Inlet Tubes

A. Wherever any fuel nozzle and support assemblies and/or fuel inlet tubes have been replaced, pressure check nozzles, manifolds, and inlet tubes involved per the following:

NOTE: As described below, pressure testing of conical-seat fuel systems which incorporate transfer tubes in fuel nozzle connections (Reference SB 4484) is performed mid-way through fuel nozzle and manifold reassembly procedure, when coupling nuts are only fingertight. Pressure test is not required on transfer tube-type assemblies after coupling nuts have been torqued.

(1) Prepare all nozzles for pressure checking by making sure that all nozzle orifices and adjacent area to orifices are clean. Since pressure check clamps can force carbon into openings and clog them, it is important that those areas which are contacted by sealing caps be clean.

NOTE: Fuel nozzle orifices can be cleaned, as required, per Chapter/Section 72-00-00, ENGINE - CLEANING.

CAUTION: FUEL NOZZLES OF "AIR CURTAIN" TYPE (REFERENCE SB 5039) MUST BE PRESSURE-TESTED USING PWA 33893 SEAL (OR EQUIVALENT) WITH EITHER PWA 14051 OR PWA 33797 CLAMP.

(2) On fuel nozzles prior to low emissions type, attach nine PWA 14051 or PWA 33797 Clamps, using PWA 33893 Seal or equivalent in each clamp, to fuel nozzles and adjust thumb screw to plug each nozzle with rubber seal.

NOTE: Clamps are not needed when performing alternate air leak check on conical seat fuel systems. See step (8).

(3) On fuel nozzles of low emissions type (reference SB 5650) attach nine PWA 45858 Clamps with PWA 35952 Seal in each clamp. On PWA 45858 Clamp at Change Letter A

or subsequent, PWA 33893 Seal may be used in place of PWA 35952.

NOTE: PWA 33893 (formerly PWA 35952) Seal must bottom in center of clamp to ensure correct relationship to seals on outside of clamp. Incorrect installation may result in leakage at secondary fuel orifice. Check protrusion of PWA 33893 (formerly PWA 35952) Seal past face of adapter (see Figure 501) and re-shim as necessary; unthread handle, drift out seal, and select shim to obtain proper seal protrusion. PWA 33893 Seal requires use of detail-10 spacer; PWA 35952 Seal does not require detail-10 spacer, but both PWA 33893 and 35952 Seals may require detail-11 shims to obtain proper protrusion. Reinstall PWA 33893 (formerly PWA 35952) Seal and check for protrusion, then reinstall handle.

(4) For JT8D-1,-1A,-1B,-7,-7A, and -7B engines without piloted shoulder bolts (prior to incorporation of SB 1585), attach PWA 12043 adapter to left primary and secondary inlet tubes. For other models and engines incorporating SB 1585, use PWA 32299 Adapter.

(5) For JT8D-11,-15,-17,-17R and other engines incorporating conical seat fuel systems (Reference SB 2722), additional adapters are required before PWA 32299 Adapter can be used. Secure Primary Fuel Manifold Adapter, PWA 32549, and Secondary Fuel Manifold Adapter, PWA 32550, to outer end of manifold coupling nut after manifold has been secured to diffuser case. Make certain proper end, as marked on tool, is secured to manifold coupling nut.

NOTE: For all engines incorporating conical seat fuel systems, PWA 33160 Adapter may be used in place of PWA 32299, PWA 32549, and PWA 32550 Adapter combination.

(6) Inspect seals for proper location and condition.

(7) Pressure test chevron-seal fuel systems as follows:

R
R

(a) Using calibrating fluid, turn on test system and pressurize primary and secondary passages with 50 psig. Loosen each plug and bleed air until test fluid issues from both primary and secondary discharge of each fuel nozzle. Resecure each plug and dry external surfaces with air blast.

CAUTION: AT NO TIME DURING TESTING MUST SECONDARY PRESSURE BE GREATER THAN PRIMARY PRESSURE.

(b) Maintain 50 psig and following pressures for five minutes each; 200, 400, and 700 psig (± 5 psi). There must be no leakage from any surface, joint, or connection.

(c) Remove test equipment from left side and install it on right side inlet tube assembly.

(d) Pressure test right side fuel passages in same manner as for left side.

(8) Pressure test conical-seat fuel systems as follows:

(a) Fluid leak check procedure.

1 Using calibrating fluid, turn on test system and pressurize primary and secondary passages with 50 psig. Loosen each plug and bleed air until test fluid issues from both primary and secondary discharge of each fuel nozzle. Resecure each plug and dry external surfaces with air blast.

CAUTION: AT NO TIME DURING FOLLOWING TEST MUST SECONDARY PRESSURE BE GREATER THAN PRIMARY PRESSURE.

2 Maintain 50 psig for two minutes. Check for leaks.

3 If no leaks occur at 50 psig, increase test pressure to 600 psig and hold for two minutes.

4 If leaks occur at any time, remove fuel nozzles and inspect fuel nozzle and support assemblies and fuel manifolds for cause of leakage. Replace transfer tube packings and retest.

R
R

5 Install test equipment on right-side inlet tube assembly and pressure test right side fuel manifolds in same manner as for left side.

6 If no leaks occur, continue with reassembly of fuel system per Removal/Installation.

(b) Air leak check procedure.

NOTE: This procedure is alternate procedure to fluid leak check for conical-seat fuel systems. If this procedure is chosen, install tooling as directed in steps (5) and (6) of this paragraph. Do not install clamps on fuel nozzles.

CAUTION: MAINTAIN EQUAL PRESSURE IN PRIMARY AND SECONDARY MANIFOLDS TO AVOID POSSIBLE DAMAGE TO FUEL NOZZLE SEALS. IF COMPRESSED AIR IS USED, EQUIPMENT MUST BE FITTED WITH FILTERS AND SEPARATORS TO PREVENT OIL, MOISTURE, OR FOREIGN OBJECT CONTAMINATION OF FUEL SYSTEM.

1 Connect pressure source with gage and regulator to primary and secondary fuel manifold adapters installed in step (5).

2 Flow air (or bottled nitrogen, if desired) through fuel system and maintain pressure in both primary and secondary manifolds of 95 - 105 psig.

3 Prepare leak check fluid (PMC 2277 or 9569) and stir it into a foam. Apply the leak check fluid foam to the fuel nozzle connector nuts with a small brush.

R NOTE: Foaming of leak check fluid is necessary to reveal leaks more clearly.

4 Check for leaks, indicated by bubbling through foaming fluid at the thread or tube side of connector nuts.

5 Shut off pressure source and remove tooling. Clean the fuel manifold area thoroughly to remove leak check fluid.

6 Test primary and secondary manifolds on right side of engine in same manner as for left side.

7 If leaks were found at any fuel nozzle connection, remove fuel nozzles and inspect nozzle and manifold connector surfaces for cause of leakage. Reassemble, with new conical seals (and transfer tube packings, if used) per Removal/Installation and retest.

8 If no leaks occur, continue with reassembly of fuel system per Removal/Installation.

(9) Retest

(a) If any leakage is present in system, replace and/or repair as required and repeat test.

(b) If for any reason any portion of system has been removed or replaced, repeat test.

(10) Remove test equipment.

Task 73-13-01-990-002:

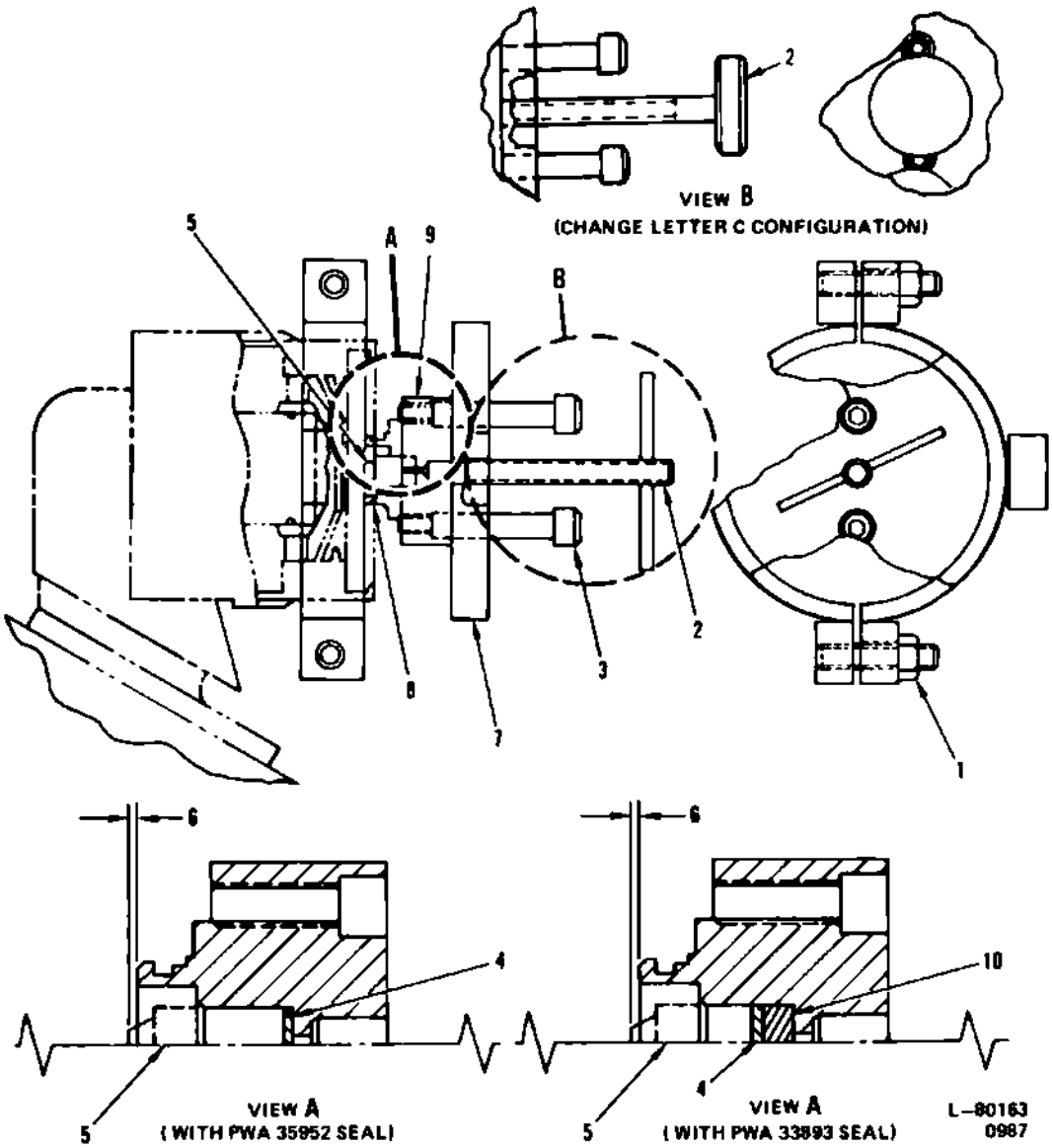
2. Tools And Equipment

A. Special Tools

PWA 12043	Adapter - Fuel Manifold Pressure Test
PWA 14051	Clamp - Fuel Nozzle Sealing (9 Required) (Replaced by PWA 33797)
PWA 32299	Adapter - Fuel Manifold Pressure Test
PWA 32549	Adapter - Primary Fuel Manifold
PWA 32550	Adapter - Secondary Fuel Manifold
PWA 33160	Adapter - Fuel Manifold Pressure Test
PWA 33797	Clamp - Fuel Nozzle Sealing (9 Required) (Replaces PWA 14051)
PWA 33893	Seal - Fuel Nozzle Clamp (Replaces PWA 35952)
PWA 35952	Seal - Fuel Nozzle Clamp (Used With PWA 45858) (Replaced by PWA 33893)
PWA 45858	Clamp - Fuel Nozzle Sealing (9 Required) (Low-Emissions Type Fuel Nozzles)

B. Consumable Materials

PMC 2277	Leak Check Fluid (Alternate to PMC 9569)
PMC 9569	Leak Check Fluid (Alternate to PMC 2277)



Low Emissions Fuel Nozzle
R Pressure Testing Tools
R Figure 501
(Task 73-13-01-990-002)

1. Hex Nut (Two)
2. Handle
3. Socket Head Screw (Two)
4. Shim Detail (Thickness As Required To Obtain Index 6 Distance)
5. PWA 35952 Or 33893 Seal
6. 0.010 - 0.030 Inch
7. Clamp
8. Packing
9. Adapter
10. Spacer (When Using PWA 33893 Seal)

Key to Figure 501

R
R

FUEL DE-ICING SYSTEM - DESCRIPTION-00

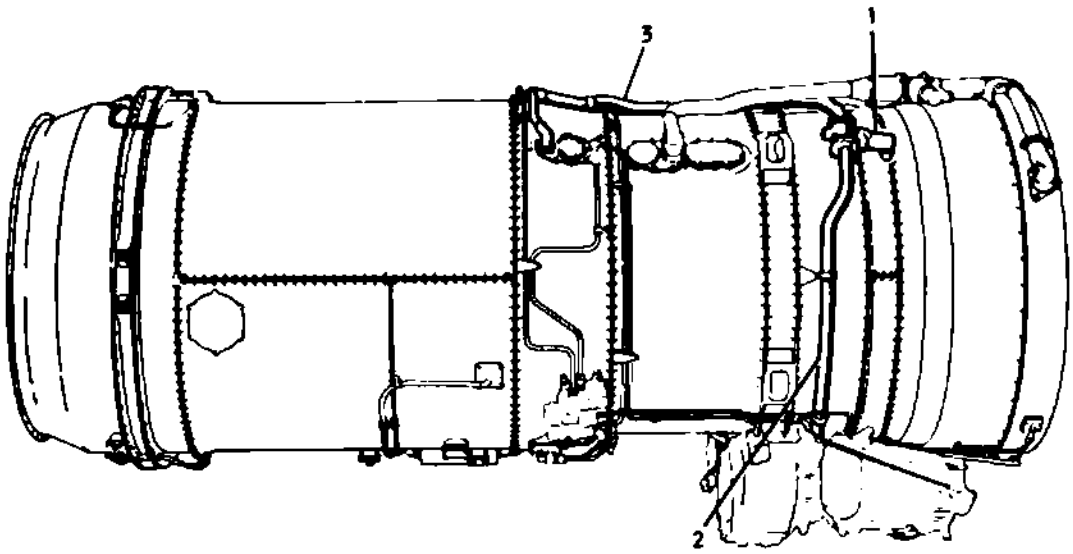
Task 73-14-00-990-001:

1. Description and Operation of Fuel De-Icing System See Figures 1 and 2

   A. The fuel de-icing system consists primarily of an air-fuel heater, air shutoff valve, differential fluid pressure switch and the necessary tubing.

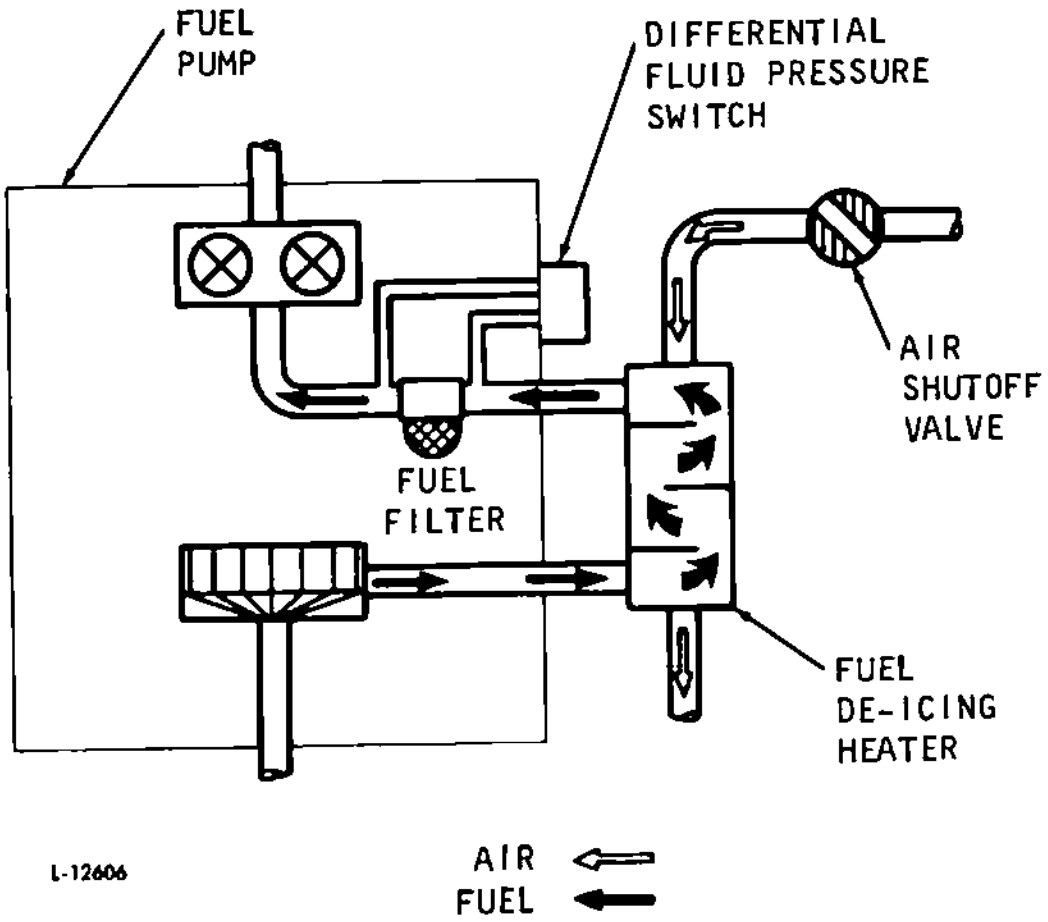
   B. The pressure drop warning switch mounted on the fuel filter indicates when the filter is iced. When the cockpit fuel heater switch is activated, an electrically actuated air shutoff valve located in the bleed air line at the inlet of the heater opens to permit high compressor discharge air to flow through the heater.

   C. The fuel de-icing heater and filter are installed in the fuel system between the boost and main stages of the engine-driven fuel pump. All of the engine fuel flow passes through the fuel de-icing heater at all times. The fuel is heated, however, only when the air shutoff valve is opened, allowing high compressor discharge air to flow through the air side of the heater.



1. FUEL DE-ICING AIR SHUT-OFF VALVE AND ACTUATOR
2. DE-ICING AIR SHUT-OFF VALVE TO FUEL HEATER TUBE
3. FUEL DE-ICING AIR MANIFOLD

Fuel De-Icing System
Figure 1
(Task 73-14-00-990-001)



Fuel De-Icing System Schematic
Figure 2
(Task 73-14-00-990-001)

Task 73-14-00-810-001:

1. General

   A. See Chapter/Section 72-00-00, Troubleshooting For Fault Isolation Procedures On Fuel System

Task 73-14-00-450-001:

1. Removal And Installation Of The Fuel De-Icing Heater See Chapter 73-14-01

Task 73-14-00-450-002:

2. Removal/Installation Of The Fuel De-Icing Air Shutoff Valve And Actuator Assembly And Fuel De-Icing Air Tubing

   A. Removal

      (1) Disconnect air frame wiring harness lead from air shutoff valve actuator.

      (2) Establish clip and bracket locations for installation purposes.

      (3) Disconnect high pressure bleed control air supply tube from rear of de-icing manifold tube.

      (4) Unfasten de-icing manifold at rear from diffuser outer duct (both sides) and, at front, from eye bracket. Remove from engine.

      (5) Unfasten de-icing manifold flange from shutoff valve upper flange and remove shutoff valve and actuator from engine.

          NOTE: Assembly incorporating SB 5706 will incorporate gasket between valve and actuator and upper tube flange. Remove this gasket and make note of location where gasket was used.

      (6) Disconnect shutoff valve lower flange from de-icing air shutoff valve-to-fuel heater tube (lower right) and remove valve and actuator. An engine pre-SB 5674 will have a bolt and nut at the lower tube eye to attach the tube and actuator to the flange bracket. Post-SB 5674 this bolt and nut are removed (it is permitted to have only one (upper) bolt with a pre-SB 5674 bracket).

      (7) Disconnect de-icing air shutoff valve-to-fuel heater tube (lower right) from shutoff valve lower side and from eye bracket.

          NOTE: Assembly incorporating SB 5706 will incorporate gasket between valve and actuator and lower tube. Remove this gasket and make note of location where gasket was used.

(8) Remove de-icing air shutoff valve-to-fuel heater tube (lower right) by removing four bolts at fuel de-icing heater.

B. Installation

(1) Install de-icing air shutoff valve-to-fuel heater tube (lower right). Secure it to pad on fuel heater assembly lower tube with bolts and locknuts (or, for early tubes, secure with bolts). Torque locknuts (or torque and lockwire bolts). Pre-SB 5674: Secure at upper end to eye bracket with bolt, large washer, small washer, and locknut. On an engine post-SB 5674, there will be only one bolt hole in the flange bracket (for the upper tube and actuator bolt). It is permitted to install the lower tube and actuator without a bolt with a pre-SB 5674 bracket.

(2) Mount fuel de-icing air shutoff valve and actuator (actuator forward) on engine right side and secure shutoff valve to tube using four nuts and bolts.

NOTE: If assembly incorporates SB 5706, install gasket between valve and actuator and lower tube flange.

(3) Place de-icing air manifold on top of engine. Secure to eye bracket at front flange with bolt, large washer, small washer, and locknut. Secure to upper flange of shutoff valve with four bolts and locknuts.

NOTE: If assembly incorporates SB 5706, install gasket between valve and actuator and upper tube flange.

(4) Connect de-icing manifold tubes to diffuser outer duct at top on both sides using, on each side, two bolts, nut, washer, and new gasket.

(5) Connect high pressure bleed control air supply tube to rear de-icing manifold tube.

(6) Tighten nuts and bolts to recommended torque and lockwire.

(7) Install clips and brackets.

(8) Connect airframe wiring harness lead to air shutoff valve actuator.

FUEL DE-ICING HEATER - DESCRIPTION-00

Task 73-14-01-990-001:

1. Fuel De-Icing Heater Description And Operation

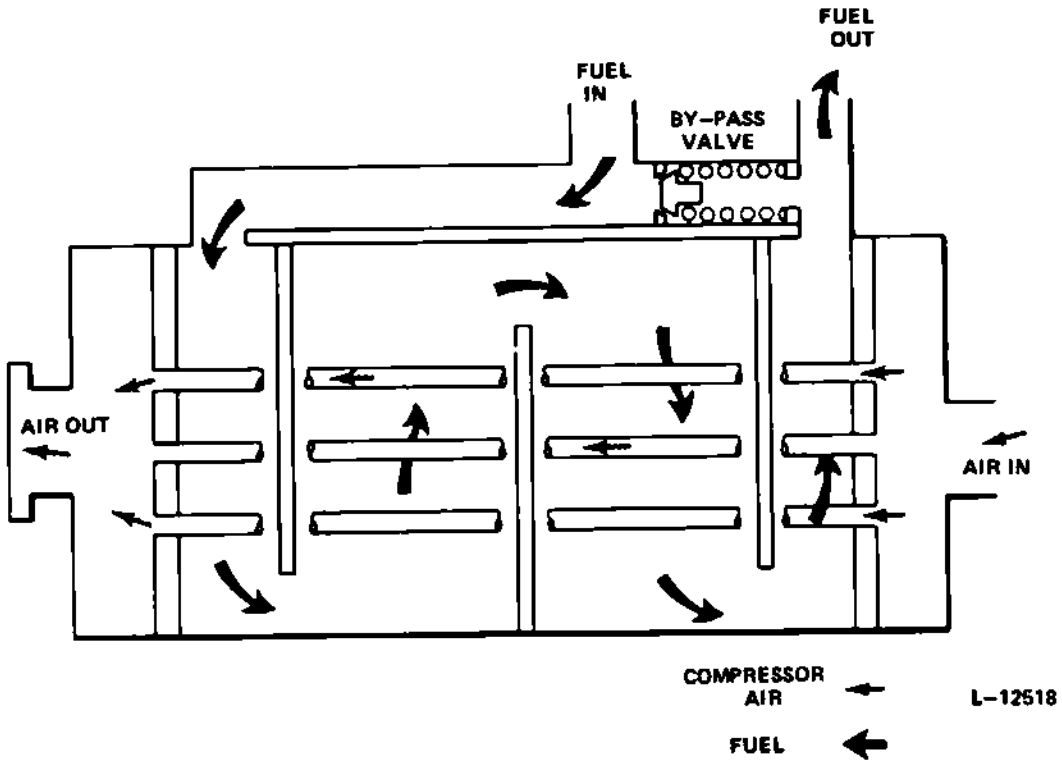
See Figure 1.

A. Description

(1) The fuel de-icing heater is located between the boost and main stages of the engine-driven fuel pump. The fuel de-icing heater functions as an air-fuel heat exchanger to protect the engine fuel system from ice. It consists of a housing containing a core composed of over 150 soda straw-like tubes through which compressor bleed air passes and around which the entire engine fuel flow is circulated; a series of baffles within the core which direct the flow of fuel around the tubes so that the fuel is uniformly heated; and a bypass valve which permits fuel flow in the event of clogging. The fuel de-icing heater uses high compressor discharge air as a source of heat, and functions only when the air shutoff valve is open, allowing high compressor discharge air to flow through the air side of the heater.

B. Operation

(1) Operation of the fuel de-icing heater is controlled manually. A differential pressure switch on the fuel de-icing filter activates a warning light in the cockpit when there is a pressure drop across the filter caused by ice or clogging. A fuel heater switch can then be actuated, to open the fuel heater air shutoff valve. Engine bleed air passes through the tubes of the heater, warming the fuel which is baffled around these tubes. The resulting warm fuel will melt any ice formation within the filter and the WARNING light will go out as the pressure drop across the filter is decreased. The heater should be used intermittently.



Fuel De-Icing Heater
Figure 1
(Task 73-14-01-990-001)

FUEL DE-ICING HEATER - REMOVAL/INSTALLATION-00

Task 73-14-01-450-001:

1. Fuel De-Icing Air System See Chapter 75

Task 73-14-01-450-002:

2. Removal/Installation of Fuel de-icing Heater Assembly

A. Removal

(1) Remove any airframe connections from front of heater.

(2) Remove four bolts (or three bolts and nuts if subsequent to SB 1005) at fuel de-icing connector tube.

(3) Unfasten locknuts that secure heater.

(4) Remove bracket and screw at left front lug of heater.

(5) Remove bracket at lower lug and move aside capillary temperature sensing tubes.

(6) Remove heater.

B. Installation

(1) Install two new seals, lubricated with a thin layer of PWA 36500 Assembly Fluid, on each of transfer tubes.

(2) Install two transfer tubes in heater.

(3) Position heater on engine and secure in position using washer and locknut at upper right lug. Tighten nut to recommended torque.

(4) Secure bracket and capillary tube clip at lower lug and bracket at upper left lug of heater using two locknuts, and screws. Tighten nuts to recommended torque.

(5) Secure heater at fuel de-icing connector tube using four bolts (or three bolts and nuts for engine incorporating SB 1005).

(6) Tighten bolts (or bolts and nuts) to recommended torque. On engine prior to SB 1005, lockwire bolts.

(7) Install any airframe connections at front of heater.

DIFFERENTIAL FLUID PRESSURE SWITCH - DESCRIPTION-00

Task 73-14-02-990-001:

1. Description

   A. The differential fluid pressure switch mounted on the fuel de-icing filter assembly measures the filter inlet and filter outlet fuel pressure difference.

Task 73-14-02-990-002:

2. Operation

   A. When icing conditions exist within the fuel de-icing filter, ice collects on the surface of the filter element causing a pressure drop in the housing. Upon reaching a predetermined pressure differential fluid pressure switch activates a warning light in the cockpit.

DIFFERENTIAL FLUID PRESSURE SWITCH - REMOVAL/INSTALLATION-00

Task 73-14-02-450-001:

1. Removal/Installation of Differential Fluid Pressure Switch

A. Removal

(1) Disconnect lead from differential fluid pressure switch.

(2) Remove four bolts and washers which secure switch to fuel filter (fuel pump).

(3) Remove switch from engine.

B. Installation

(1) Install two new seals at ports on switch.

(2) Using four washers and bolts secure switch to fuel filter (fuel pump) on engine.

(3) Tighten bolts to recommended torque.

(4) Connect lead to differential fluid pressure switch, and tighten to recommended torque.

FUEL TUBES - DESCRIPTION-00

Task 73-15-01-990-001:

1. Description of Fuel Tubes

   A. The divided fuel flow (primary and secondary) from the fuel pressurizing and dump valve is delivered through two short external manifolds to two points on the exterior of the diffuser case outer fan duct at the five and seven o'clock positions. These tubes lead through the annular duct to the left and right fuel manifold tubes which are mounted on the exterior of the diffuser case. The left manifold tubes supply fuel to the nozzles for the combustion chambers six, seven, eight, nine, and one. The right manifold tubes supply fuel to the nozzles for chamber numbers two, three, four, and five.

Task 73-15-01-450-001:

1. Removal/Installation of the Primary and Secondary Fuel Supply Manifolds

A. Removal

(1) Remove clips holding manifolds to bottom of engine.

(2) Disconnect primary and secondary fuel manifolds at pressurizing and dump valve and at fuel inlet tubes (5 and 7 o'clock position).

(3) Remove manifolds from engine.

B. Installation

(1) Primary Fuel Supply Manifold (Chevron Seal Configuration).

CAUTION: FOR ENGINES POST SB 6348, MAKE SURE THE COUPLING NUT AND FERRULE BEING USED ARE THE CORRECT PART NUMBER FOR "IN SETS" USE WITH THE FUEL SUPPLY MANIFOLD.

(a) Position new keywasher and the coupling nut on the middle tube of the primary fuel manifold. See Figure 401.

(b) Install ferrule, new packing (lubricated with a thin layer of PWA 36500 Assembly Fluid) and retainer over middle tube end.

CAUTION: IF RETAINER IS NOT USED PACKING MAY PROTRUDE BETWEEN THE TUBE AND THE CONNECTOR AND PIECES OF RUBBER MAY ENTER THE SYSTEM.

(c) Install retainer, new packing, lubricated with a thin layer of PWA 36500 Assembly Fluid, and second retainer on ferrule end (right) of primary manifold.

(d) Install new packing, lightly coated with PWA 36500 Assembly Fluid, and retainer on manifold tube at left end. The adapter assembly in the pressurizing and dump valve boss incorporates a coupling nut held by a thrust wire inside. Coupling nut and thrust wire must be in place.

(e) Position the primary manifold on the engine and secure the nuts at both fuel inlet tubes and at the pressurizing and dump valve. Tighten nuts to recommended torque and lockwire.

(f) Position the stop nut against the stop on the tube and tighten the stop nut and the coupling nut together fingertight. Back off one half turn maximum to next slot on the stop nut and bend the tabs of the keywasher to clinch the stop nut.

(g) Check the thread engagement between the stop nut and the coupling nut. It must be such that a No. 60 wire will not pass through the 0.0625 inch diameter stop nut holes.

(h) Secure the manifold to the bracket with the clips.

(2) Install Primary Fuel Manifold (Conical Seat Configuration).

(a) Install new packings lightly coated with PWA 36500 Assembly Fluid and retainers on both tube ends and elbow and elbow end of manifold.

(b) Position primary manifold on engine and secure nuts at both fuel manifold inlet ends and at fuel pressurizing and dump valve. Tighten nuts to recommended torque and lockwire.

(c) Secure manifold to bracket with clip.

(3) Secondary Fuel Supply Manifold.

(a) Prepare the middle tube of the secondary fuel manifold in the same manner (using the proper secondary manifold parts) as for the primary middle tube, steps (1), (a), (b), (c), and (d).

(b) Install a new packing, lubricated with a thin layer of PWA 36500 Assembly Fluid, and a retainer on each of the other two ends of the secondary fuel manifold.

(c) Position the secondary fuel manifold on the engine and secure the nuts at both fuel inlet tubes and at the pressurizing and dump valve. Tighten the nuts and lockwire.

(d) Secure the manifold to the bracket with the clips.

(4) Install Secondary Fuel Manifold (Conical Seat Configuration).

(a) Install new packings lubricated with a thin layer of PWA 36500 Assembly Fluid and retainers on both tube ends and elbow end of manifold.

(b) Position secondary manifold on engine and secure nuts at both fuel manifold inlet ends and at fuel pressurizing and dump valve. Tighten nuts to recommended torque and lockwire.

(c) Secure manifold to bracket with clip.

Task 73-15-01-450-002:

2. Fuel Flowmeter Inlet Tube Assembly - Removal/Installation

A. Removal

(1) Remove clips holding tube assembly to engine.

(2) Disconnect tube assembly at fuel control and flowmeter ends and remove assembly from engine.

B. Installation

(1) Assembling ferrule, packing, retainers, nut and keywasher as in paragraph 1.B., steps (a) through (d), position the assembly on engine.

(2) Torque and lockwire nut at flowmeter adapter and bolts at fuel control end of tube assembly.

(3) Attach clips to hold tube assembly in place on engine.

Task 73-15-01-450-003:

3. Fuel Manifold Inlet Tube Assemblies - Chevron Seal Type Only - Removal/Installation See Figures 402 and 403.

NOTE: Combustion section outer duct and diffuser case inner duct strap must be removed by Section 72-40-00, Removal/Installation-00.

A. Removal

(1) Unfasten four nuts and remove packing holders and spacers from outside fuel inlet tube assemblies (at five and seven o'clock position on diffuser outer duct).

(2) Reach inside fan discharge duct and remove screws holding diffuser section inner duct half.

(3) Move lower half of inner duct away from diffuser case.

(4) Remove four bolts from inlet tube assemblies at diffuser case.

(5) Remove fuel inlet tube assemblies.

B. Installation

(1) Install Inlet Tube Assemblies With Welded Fairings.

(a) Install and secure each inlet tube assembly to manifold on diffuser case, using new gasket and four bolts (tubes facing front).

(b) Tighten bolts to recommended torque and lockwire.

(c) Reposition lower half of the inner duct on diffuser case and secure to diffuser case with screws.

(d) Install new packing on each packing holder.

(e) Install new packing in the groove of lower flange of fuel manifold inlet tube assembly.

(f) Lubricate new packings with a thin layer of PWA 36500 Assembly Fluid and install packing holders against inlet tube bosses on bottom (five and seven o'clock) of fan discharge diffuser section outer duct.

(g) Secure each packing holder with four sleeve spacers and locknuts. Tighten locknuts to the recommended torque.

(h) Pressure test installed inlet tube assemblies by Section 73-13-01, Adjustment/Test-00.

(i) Reinstall diffuser case inner duct strap, combustion section outer duct and related parts, by Section 72-40-00, Removal/Installation.

(2) Install Inlet Tube Assemblies With Fairings With Rubber Grommets.

NOTE: Fuel manifold inlet tube assemblies requiring rubber grommets and bolt on fairings must be used as a complete set, when interchanged with fuel manifold inlet tube assemblies with welded fairing configuration.

(a) Install and secure each inlet tube assembly to manifold on diffuser case, using new gasket and four bolts (tubes facing front).

(b) Tighten the bolts to the recommended torque and lockwire.

(c) Install grommets on fuel manifold tubes at locations shown in Figure 402, to establish contact area of tubes.

NOTE: Place large diameter grommet holes around large diameter (secondary) fuel manifold tube.

(d) Apply adhesive to mating surface of grommets and all around contacting area of tubes and grommet. Install grommets.

NOTE: To help installation and prevent possible grommet slippage during curing, grommet halves may be preglued, as shown in Figure 403, and allowed to cure for 24 hours at room temperature before installation.

(e) Rubber chafing sleeve (reference PN 5003033-01) must be installed over spacers on rear fairing half. Heat to 350° - 400°F (177° - 204°C) to shrink plastic. Plastic chafing sleeve must fit snugly over spacer.

(f) Assemble fairing halves in position, overlapping front fairing half over rear fairing half; then

bolt together. Allow adhesive to cure 24 hours before using engine. See Figure 402.

NOTE: Adhesive may be purchased from General Electric Co., Waterford, New York 12188 (as G.E. RTV-159 Adhesive). It is to be understood that Pratt & Whitney does not endorse the work performed by the company or companies named herein as possible sources for accomplishment of the required work or supplies to be procured and does not accept responsibility to any degree for the selection of such company or companies for such work performed or for such supplies procured.

(g) Reposition the lower half of the inner duct on the diffuser case and secure to the diffuser case with the screws.

(h) Install a new packing on each packing holder.

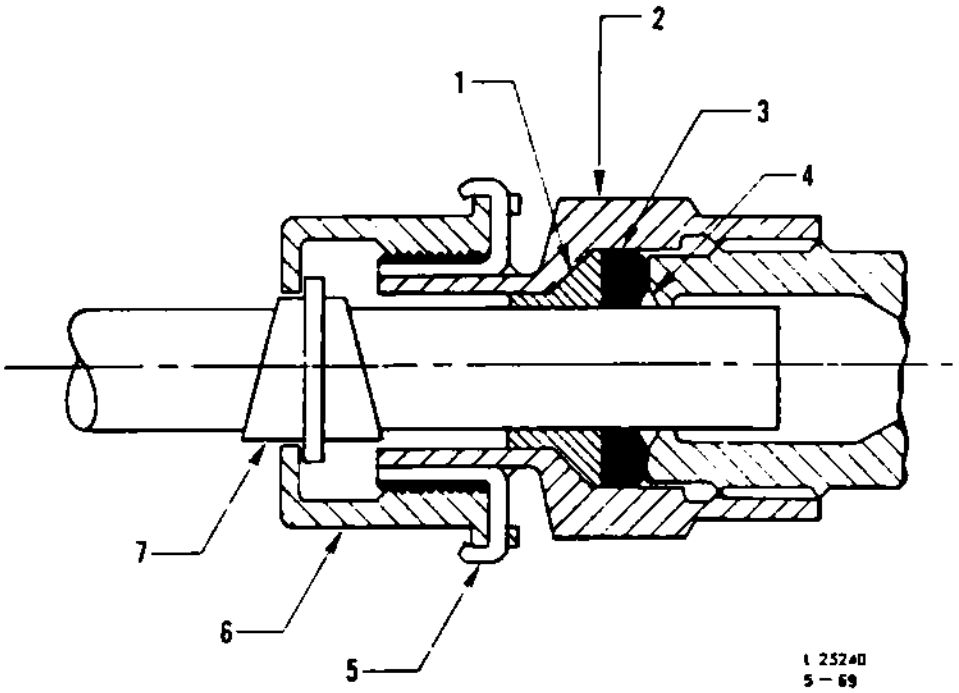
(i) Install a new packing in the groove of the lower flange of the fuel manifold inlet tube assembly.

(j) Lubricate the new packings with a thin layer of PWA 36500 Assembly Fluid and install the packing holders against the inlet tube bosses on the bottom (five and seven o'clock) of the fan discharge diffuser section outer duct.

(k) Secure each packing holder with the four sleeve spacers and locknuts. Tighten locknuts to the recommended torque.

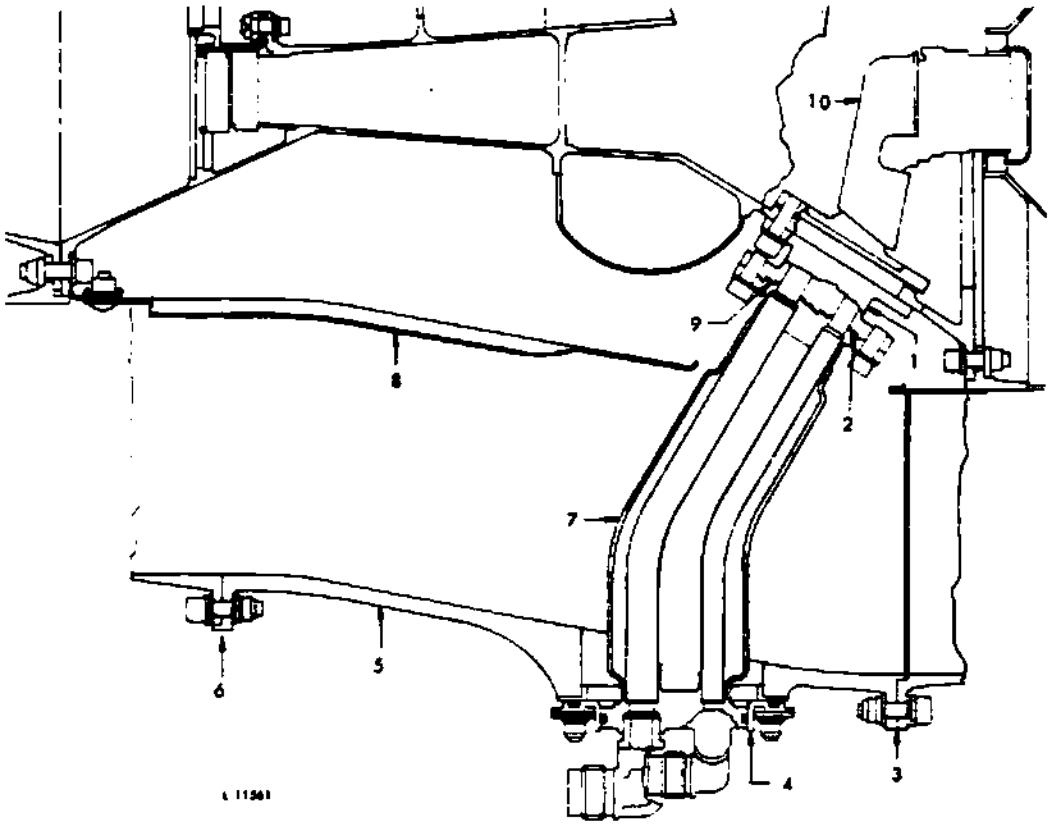
(l) Pressure test installed inlet tube assemblies per Section 73-13-01, Adjustment/Test-00.

(m) Install diffuser case inner duct strap, combustion section outer duct and related parts, by Section 72-40-00, Removal/Installation-00.



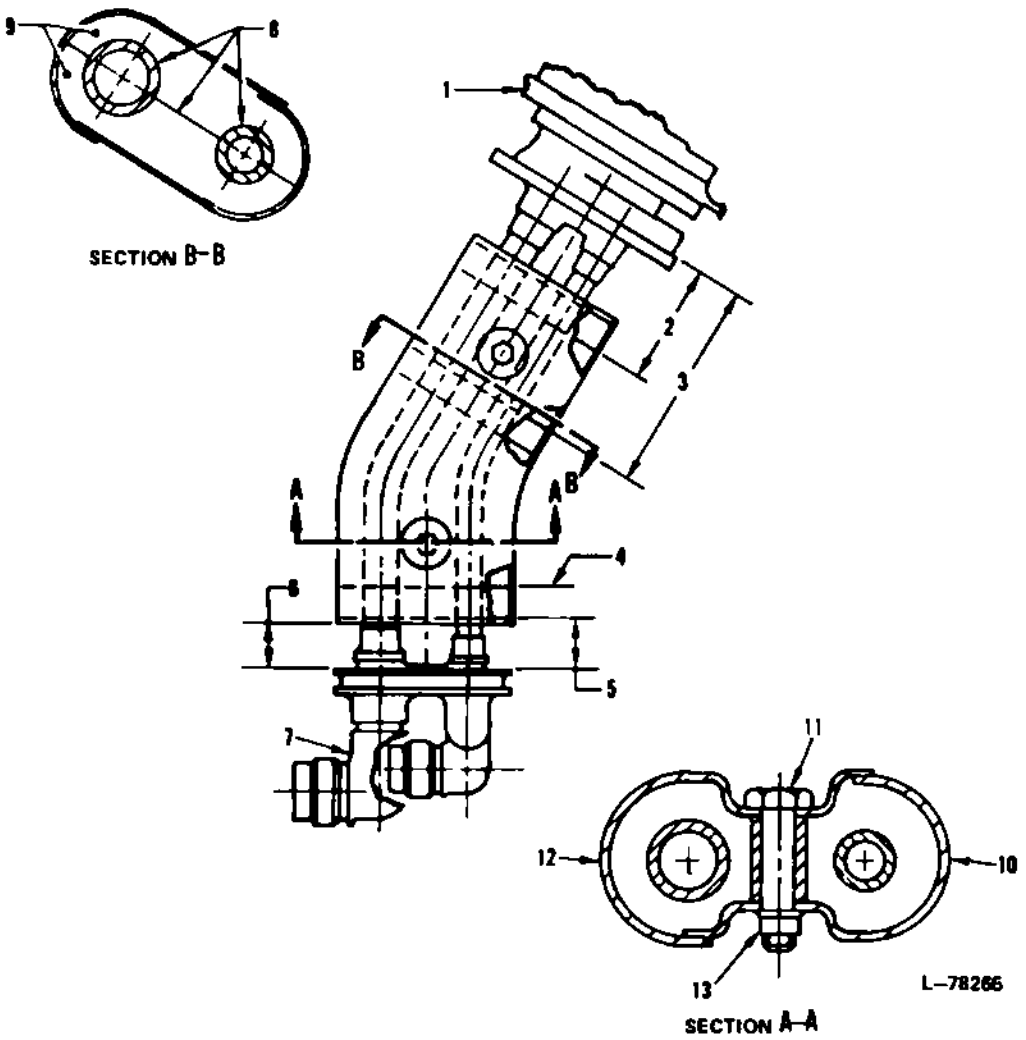
1. Ferrule
2. Coupling Nut
3. Packing
4. Retainer
5. Keywasher
6. Stop Nut
7. Stop

Fuel Manifold Stop Nut Connection
Figure 401
(Task 73-15-01-450-003)



1. Detail of Fuel Manifold
2. Metal Gasket
3. Flange J
4. Packing Holder
5. Fan Discharge Diffuser Section Outer Duct
6. Flange H
7. Fuel Manifold Inlet Tube Assembly (With Welded Fairings)
8. Fan Discharge Diffuser Section Inner Duct
9. Metal Gasket (Large)
10. Fuel Nozzle and Support Assembly

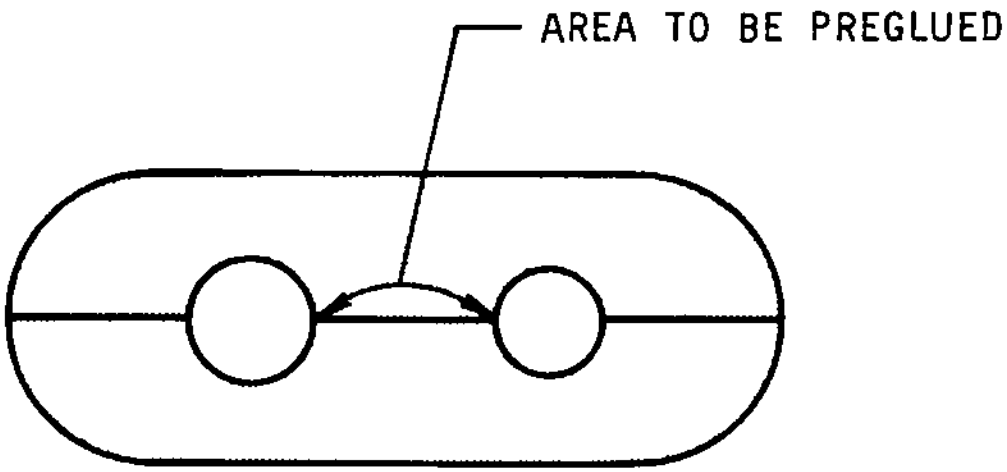
Fuel Inlet Tube Assemblies
- Chevron Seal Type Only
Figure 402 (Sheet 1)
(Task 73-15-01-450-003)



Fuel Inlet Tube Assemblies
- Chevron Seal Type Only
Figure 402 (Sheet 2)
(Task 73-15-01-450-003)

1. Diffuser Case Mounting Boss
2. 1.610 - 1.670 Inch
3. 2.860 - 2.920 Inch
4. Grommet Halves, Three Places
5. 0.530 - 0.590 Inch
6. 0.490 - 0.530 Inch
7. Manifold Assembly
8. Adhesive
9. Grommet Halves
10. Rear Fairing Assembly
11. Bolt
12. Front Fairing
13. Nut

Key to Figure 402 (Sheet 2)



Pregluing Of Fuel
Manifold Grommets
Figure 403
(Task 73-15-01-450-003)

FUEL CONTROL (JFC60-1) - DESCRIPTION-00

Task 73-21-01-990-002:

1. General

A. The JFC60 fuel control having a sensor type pressure regulating valve is designed to schedule the fuel flow required by the engine to deliver the designed amount of thrust as dictated by the power lever position and the particular operating conditions of the engine. Two control levers are provided, one, the power lever to control the engine during forward or reverse thrust operation and the other, the shutoff lever, to effect engine shut-down and starting by closing and opening a fuel shut-off valve.

B. The fuel control accurately governs the engine steady state selected speed and regulates acceleration and deceleration fuel flows. The speed governing system is of the proportional or droop type.

C. The fuel control consists of a metering and a computing system. The metering system selects the rate of fuel flow to be supplied to the engine combustion chambers in accordance with the amount of thrust demanded by the pilot, but subject to engine operating limitations as scheduled by the computing system as a result of its monitoring various engine operational parameters. The computing system senses and combines the various parameters to control the output of the metering section of the fuel control during all regimes of engine operation.

D. Metering System

(1) High pressure fuel is supplied to the control inlet from the engine-driven fuel pump. This fuel initially encounters the coarse filter which protects the metering system against large particles of fuel contaminants. The fuel then encounters the fine servo supply filter which further protects the computing system against solid contaminants. This filter is self-cleaning due to the fact that fuel velocity through the axis of the cylinder toward the metering section is significantly greater than that of the flow through the mesh supplying the servo control valves. Both filters are protected by valves that open to allow the fuel to bypass in the event the screens become clogged to a point where the fuel flow is restricted.

(2) The main fuel flow stream then flows through the metering valve (throttle valve) across which a constant pressure differential is maintained by the pressure regulating valve system. The throttle valve is a window type valve and is positioned by a half area servo. This valve consists essentially of a fixed and a movable sleeve and an extension spring which is attached to the multiplying lever. The movable sleeve (piston) position is controlled by a rotating pilot valve which is displaced from its hydraulic null (steady-state) position by compressor discharge pressure, engine speed, compressor inlet temperature, power lever, or any combination of these parameters. These actuating signals work in conjunction with each other to produce a net torque on the multiplying lever. A balancing torque is created by the throttle valve extension spring load varied with the valve position. As long as the resultant torque is zero, the throttle valve maintains a constant position. However, any change in the signal torque will displace the pilot valve and cause motion of the throttle valve piston until the unbalanced signal torque is balanced by the new throttle valve position and corresponding spring force. By virtue of the constant pressure drop maintained across the throttle valve, fuel flow is proportional to the position of the piston. The fuel flow rate for the full travel of the throttle valve is externally adjustable by rotation of the outer sleeve relative to the piston. An adjustable stop is provided which is preset for a specific maximum value of fuel flow. An adjustable stop is also provided to limit the motion of the piston in the decrease fuel flow direction to permit selection of the proper minimum fuel flow.

(3) In order for the control to ensure a predictable flow through the selected valve window opening the pressure drop across the throttle valve is maintained at 40 psi by a bypass type regulating valve and sensor. All high pressure fuel in excess of that required to maintain the pressure differential is bypassed to pump interstage. The flow forces acting on the regulating valve are compensated for by utilizing the impulse bucket principle to improve the accuracy of the basic valve, thereby minimizing the work required of the pressure regulating valve sensor and thus increasing the accuracy of pressure regulation. The lower end of the pressure regulating valve is subjected to servo supply pressure. The upper end is balanced by a

modulated pressure nominally 30 psi less than throttle valve supply and a spring force equivalent to 30 psi. Any deviation from this nominal setting will displace a rotating pilot valve from its hydraulic null position and cause motion of the pressure regulating valve. The pressure regulating valve will then bypass more or less of the fuel flow to maintain the nominal pressure differential, and return the sensor to its equilibrium position. In the event of a failure in the direction of low throttle valve pressure drop, the control will meter at the spring force equivalent pressure (30 psi) and prevent bypassing the total flow back to pump interstage. A ball type relief valve is used between the modulated pressure and throttle valve downstream pressure to limit the difference to 20 psi. This limits throttle valve pressure drop to 50 psi in case of a sensor malfunction in the direction of high throttle valve pressure drop. Variations in fuel temperature are compensated for by the action of a bimetallic disc working on the 40 psi (nominal) equivalent reference spring in the pressure regulating valve sensor. The pressure regulating valve is capable by bypassing 16,000 pounds per hour flow with a pressure drop across the bypass ports below 135 psi. This low pressure drop prevents the pump from operating against an excessively high head or causing large increases in fuel temperature.

(4) Fuel leaving the throttle valve passes through the minimum pressure and shutoff valve on its way to the engine. This valve is essentially a plunger type valve, spring loaded to the closed position, and is designed to shut off the flow of metered fuel to the engine when the pilot moves the shutoff lever to the "OFF" position. When actuated for the shutoff function, high pressure is directed to the spring side of the valve by the action of the windmill bypass and shutoff valve. This pressure closes the valve and allows the spring to keep it in the shutoff position. When the shutoff lever is moved to the "ON" position, the high pressure on the spring side of the valve is replaced by pump interstage pressure and when metered fuel pressure has increased sufficiently to overcome the spring and interstage fuel pressure force, the valve opens and fuel flow to the engine is initiated. Thereafter, the valve will provide a minimum operating pressure within the fuel control, ensuring that adequate pressure is always available for operation of the servos at low flow conditions.

(5) The windmill bypass and shutoff valve, in addition to supplying the high pressure signal for the shutoff function, also provides a windmill bypass feature. This valve is plumbed to a line leading to the spring side of the pressure regulating valve and is positioned by a shutoff lever operated cam so that signals are generated at the desired shutoff lever positions. Movement of the shutoff lever toward the shutoff position displaces the valve, thereby porting the pressure on the spring side of the pressure regulating valve to pump interstage. This pressure regulating valve now operates as a relief valve to handle the full windmilling fuel flow.

E. Computing System

(1) The computing system positions the throttle valve to control fuel flow during steady state operation, acceleration and deceleration by using the ratio of metered fuel flow to engine compressor discharge pressure (Wf/Ps4) as a control parameter. The positioning of the throttle valve by means of the Wf/Ps4 parameter is accomplished through a multiplying system whereby the Wf/Ps4 signal for acceleration, deceleration or steady state speed control is multiplied by a signal proportional to compressor discharge pressure to provide the required fuel flow.

(2) The compressor discharge pressure sensor assembly consists essentially of a pair of matched bellows, the evacuated and the motor bellows, and a sensor lever. The motor bellows is externally exposed to compressor discharge pressure and is referenced to an evacuated bellows of equal size to produce a resultant force which is proportional to absolute compressor discharge pressure. This force is transmitted through a sensor lever to a set of rollers whose position is proportional to the required Wf/Ps4 ratio. These rollers ride between the sensor lever and a multiplying lever. The force, is transmitted through the rollers to the multiplying lever. Any change in the roller position or the compressor discharge pressure signal results in an unbalanced torque which will displace the rotating throttle valve pilot valve from its hydraulic null position, valve extends or relaxes the throttle valve feedback spring which will return the multiplying lever to its equilibrium position when the throttle valve reaches the required fuel flow position. Both the motor and evacuated bellows are located in a

chamber vented through an orifice to ambient pressure so that in event of an evacuated bellows failure, the fuel flow error is only the difference between the flow required for the absolute pressure reading and the required for a gage pressure reading. In the event of a motor bellows failure, compressor discharge pressure will be sensed on the external surface of the evacuated bellows and the system will continue to function.

(3) The compressor discharge pressure limiter assembly consists of two poppet valves, a filter screen, a leaf spring and support, a support housing and seat and the limiter housing. The compressor discharge pressure limiting valve is held seated by the action of the spring at Ps4 values below the limiting pressure. Signal pressure to the Ps4 bellows is tapped off between the two valve seats and, below the limiting point, the bellows signal pressure and compressor discharge pressure are equal. When compressor discharge pressure exceeds the limiting valve, the spring force is overcome and the limiter valve opens to bleed off compressor discharge pressure and thereby reduce the bellows signal pressure.

(4) The speed sensing governor consists essentially of a rotating pilot valve, the flyweights and the flyweight head. The engine speed signal is transmitted from the engine driven driveshaft through a gear train to the centrifugal type flyweight governor. This governor controls movement of the speed servo (3-D cam) by displacing the rotating pilot valve from its hydraulic null position. When the speed changes, the flyweight force varies and the pilot valve is displaced causing motion of the speed servo. This motion of the speed servo repositions the pilot valve, through the action of a feedback lever working on a spring, until the speed sensing governor returns to null position at the new speed servo position. The position of the speed servo is, therefore, indicative of actual engine speed. The 3-D cam is contoured to protect against the condition of a broken speed sensing driveshaft. In the event of such a failure, the speed servo bottoms in its bore while the push rod on the speed servo bottoms on an adjustable stop set near the zero speed position to eliminate feedback to the speed governor pilot valve. The 3-D cam then places the limiting linkage at the Wf/Ps4 ratio corresponding to the value selected for this failure condition.

(5) Acceleration control is provided by adjustment of the roller positioning linkage to effect a maximum Wf/Ps4 ratio stop for a particular value of speed and compressor inlet temperature. The maximum Wf/Ps4 ratio value at the stop is controlled by a three dimensional (3-D) cam which is translated by a signal proportional to engine speed and rotated by a signal proportional to compressor inlet temperature. The 3-D cam is so contoured as to define a schedule of Wf/Ps4 versus compressor inlet temperature which is used as a limiting value for each speed throughout the transient acceleration range. This combination will permit engine acceleration within the overtemperature and surge limits of the engine. When the acceleration limiting lever is in operation to control the maximum value of the Wf/Ps4 ratio, it overrides the speed setting linkage.

(6) Deceleration control is provided by the constant radius portion of the droop cam and by adjustment of the roller positioning linkage to limit the travel of the rollers toward decreasing fuel flow, thereby effecting a minimum Wf/Ps4 ratio. This provides a linear relationship between fuel flow and compressor discharge pressure which results in blow-out free deceleration.

(7) Engine speed control is accomplished by comparing the actual speed, as indicated by the position of the speed servo, to the desired speed value required for the power selected by the pilot through a power lever positioning the speed set cam. The power lever actuates the speed set cam to select a governor droop line. The position of the droop line is biased by compressor inlet temperature. The deviation of desired speed from the actual speed (speed error) causes movement of the speed servo. This movement of the speed servo is transmitted through a lever and results in the repositioning of the droop cam. The rollers in the multiplication system are positioned through the action of the droop cam to be a function of the speed error. The repositioning of the rollers then provides the required steadystate Wf/Ps4 ratio setting.

(8) The temperature sensor bellows assembly consists of the motor and compensating bellows unit, a feedback lever, a pilot valve, and output lever and push rod, a compensating lever and push rod, and the temperature sensor housing. Compressor inlet temperature is sensed by a liquid-filled bulb mounted in the compressor

inlet and connected to a liquid-filled bellows in the control. The liquid expands with increased temperature and the extra volume travels through a capillary tube to the liquid filled motor bellows in the control. The bellows length changes and through levers displaces a fourway pilot valve which results in movement of the temperature servo piston. The servo piston is connected through a linkage to a rack which meshes with the spline on the 3-D cam and motion of the piston rotates the cam. The feedback lever is attached to the rack and as the rack moves to rotate the cam, it also repositions the pilot valve in order to return the valve to the steady-state position. The rotation of the 3-D cam, acting through a linkage, resets the governor droop and acceleration line. Any ambient air or fuel temperature variation which acts on the motor bellows and capillary tube also acts on a compensating bellows and deadended capillary tube causing the fixed pivot of the motor bellows lever system to move to a new position so that the net result of the variation is not sensed at the pilot valve.

Task 73-21-01-450-001:

1. Removal/Installation of Fuel Control (Engines Having Sensor Type Pressure Regulating Valve)

NOTE: See Chapter/Section 73-11-01, Removal/Installation-00 for alternate procedure.

A. Removal
See Figure 401.

(1) Disconnect the fuel control power lever linkage.

(2) Disconnect the fuel control rear Ps4 or Pb tube from the fuel control at the condensation trap. Remove the fuel control front Pb tube from between the condensation trap and the fuel control limiter housing.

(3) Remove the fuel flowmeter inlet tube. Refer to Chapter/Section 73-15-01, Removal/Installation-00.

(4) Remove the inlet temperature bulb and lead from the inlet case.

NOTE: The inlet temperature bulb and lead are an integral part of the fuel control. Carefully coil the lead to avoid kinking and wrap the temperature bulb in protective paper.

(5) Provide support for the fuel control. Loosen and remove the nuts which attach the fuel control to the fuel pump. Separate the control from the pump.

NOTE: Remove the locknut indicated in the figure. Use PWA 45246 Wrench Adapter for better access.

(6) Remove the condensation trap and fittings for transfer to the replacement control.

B. Installation
See Figures 401 and 402.

(1) Install the condensation trap and fittings on the fuel control.

NOTE: Do not install the connector in the limiter housing (later engines) until the burner pressure bellows has been filled with oil (see paragraph D).

(2) Install the new seal in the groove around the fuel control coupling shaft port.

(3) Install the new seal in the groove around the fuel control inlet port.

(4) Coat the fuel control shaft splines with engine oil.

CAUTION: EXTREME CARE MUST BE EXERCISED DURING INSTALLATION TO MAKE SURE THAT THE FUEL PUMP AND FUEL CONTROL SPLINES ARE POSITIVELY ENGAGED IN ORDER TO AVOID DAMAGE TO THE FUEL CONTROL DRIVE SHAFT BEARING. IF THE ENGINE IS STARTED WITH THE CONTROL ASSEMBLED INCORRECTLY, THE ENGINE WILL CONTINUE TO ACCELERATE WITH NO POWER LEVER RESPONSE. THIS MALFUNCTION RESULTS FROM A LACK OF ROTATION OF THE CONTROL DRIVE, CAUSING A FLOW REGULATION ON ZERO SPEED SCHEDULE ONLY. IF THIS PROBLEM OCCURS, THE CONTROL MUST BE REMOVED FOR DRIVE GEAR BEARING INSPECTION.

(5) Position the control on the pump. Install large nut and washer on top stud. Install three washers and three locknuts on remaining studs. Tighten locknuts to recommended torque.

NOTE: Install the upper left locknut (see figure) with PWA 45246 Wrench Adapter (this tool has three-inch effective length). Attach a standard 3/8 inch drive torque wrench to the adapter.

(6) Install the inlet temperature probe in the inlet case. Secure the probe to the inlet case with bolts. Secure the temperature cable with clips, spacers, grommets, bolts and nuts. Attach the integral cable clip to Flange D with the appropriate spacer and bolt. Torque and lockwire the bolts.

(7) Install the fuel flowmeter inlet tube. Refer to Chapter/Section 73-15-01, Removal/Installation-00.

(8) Connect the fuel control rear Ps4 or Pb tube to the fuel control condensation trap. Torque the connection and lockwire.

(9) Connect the fuel control power lever linkage.

C. Procedure for Filling Burner Pressure Bellows (Hamilton Sundstrand Fuel Controls Parts List No. 583500, 710110, 743802, 743802-1 through 743802-4, 743803, and 743803-1 through 743803-4) with Silicone Oil.

(1) Remove the burner pressure limiter and transfer tube (reference HSD PN 576881) from fuel control. See Figure 402 (Sheet 1).

NOTE: Care should be used in handling limiter assembly so as not to disturb its setting.

(2) Attach a 2 foot length of 1/4 inch ID clear plastic tubing to limiter end of transfer tube and reinstall transfer tube on control.

R (3) Fill a plastic tube approximately one-half full with
R SPOP 6 solvent and attach the open end of the tube to
R an air pressure source regulated to make sure that the
R pressure will not be more than 40 psig.

R NOTE: Refer to Section 70-21-00 in the Standard
R Practices Manual, PN 585005 (Task
R 70-21-00-110-900) for SPOP 6.

R (4) Hold the tube approximately 10 inches above the level
R of the burner pressure bellows chamber and cycle the
R pressure from zero to approximately 30 - 40 psig,
R approximately 60 times or until water droplets no
R longer rise in the column of solvent.

R (5) Remove the bellows sensor cover (reference HSD PN
R 578195) and blow all solvent from the bellows area,
R transfer tube, and plastic tube.

(6) Check bellows area for presence of water and if any is noted, repeat steps (3) and (5).

CAUTION: THE OIL USED TO FILL THE FUEL CONTROL BELLOWS IN THIS PROCEDURE MUST BE ONE OF THE OILS SPECIFIED BELOW. NO OTHER OILS ARE APPROVED. THESE OILS HAVE A SPECIFIC GRAVITY OF MORE

THAN 1.0 AND HAVE COLD FLOW CHARACTERISTICS TO -65°F (-53°C).

(7) Fill bellows area as much as possible with silicone oil using a suitable syringe and hypodermic needle.

NOTE: Care should be exercised to inject oil downward into cylindrical portion of bellows cavity connecting upper and lower housings. Silicone oil is available as PRC Inc.'s Prosil 52 M-20 (to the mil spec Mil-S-81087) or Prosil 52 M-25 (to the commercial specification). These are available as Nyosil-M-20 and Nyosil-M-25 from PRC's distributor: Nye Lubricants P.O. Box 8927 New Bedford, MA USA 02742-8927 TEL: (508) 996-6721 FAX: (508) 997-5285

(8) Replace sensor cover (reference HSD PN 578195) using new preformed packing (reference HSD PN 69483P070-676), and fill cover area with silicone oil.

(9) Install transfer tube (reference HSD PN 576881) with plastic hose still attached using new packing (reference HSD PN 69890-2).

(10) Fill plastic hose half-full with silicone oil and pressure cycle as outlined in step (4), approximately 60 times to completely fill the cavity of bellows area with oil.

(11) Fill inlet passage of limiter with silicone oil and using new packings (reference HSD PN 69890-2) on transfer tube, assemble limiter to control.

(12) Install fuel control front Pb tube between condensation trap and fuel control limiter housing. Torque connections and lockwire.

D. Procedure for Filling Burner Pressure Bellows (Hamilton Sundstrand Parts List No. 710777, 707658, 742511, 742511-1, 743801, and 743801-1) with Silicone Oil.

CAUTION: THE OIL USED TO FILL THE FUEL CONTROL BELLOWS IN THIS PROCEDURE MUST BE ONE OF THE OILS SPECIFIED BELOW. NO OTHER OILS ARE APPROVED. THESE OILS HAVE A SPECIFIC GRAVITY OF MORE

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R

THAN 1.0 AND HAVE COLD FLOW CHARACTERISTICS TO -65°F (-53°C).

(1) Fill burner pressure bellows and limiter cavity completely to level of burner pressure inlet port opening with silicone oil. See Figure 402 (Sheet 2).

NOTE: Care should be exercised to inject oil downward into cylindrical portion of bellows cavity connecting upper and lower housings.

Silicone oil is available as PRC Inc.'s
Prosil 52 M-20 (to the mil spec Mil-S-81087) or
Prosil 52 M-25 (to the commercial specification).
These are available as Nyosil-M-20 and Nyosil-M-25
from PRC's distributor:

Nye Lubricants
P.O. Box 8927 New Bedford, MA USA 02742-8927
TEL: (508) 996-6721
FAX: (508) 997-5285

(2) Install connector (with new preformed packing) in limiter housing.

(3) Install fuel control front Pb tube between condensation trap and fuel control limiter housing. Torque connections and lockwire.

E. Engine Testing After Fuel Control Replacement

(1) Test engine per Chapter/Section 72-00-00, Adjustment/Test-01 after replacing fuel control.

NOTE: On Boeing 737 aircraft with Full Regime Auto-Throttle (FRAT), adjust Linear Variable Differential Transducer (LVDT) per Boeing 737 Maintenance Manual, Autoflight Section Adjustment/Test.

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Task 73-21-01-450-002:

2. Removal/Installation of the Fuel Control Main Filter Group

NOTE: Main filter group includes fuel control main filter and servo fuel filter.

A. Removal

(1) Remove socket head cap screw and flat washer; then remove two retaining rings.

(2) Thread long shank bolt into hole in center of valve cap and, using bolt as a puller, remove main filter and filter valve group.

(3) Remove preformed packing from valve cap and two preformed packings from filter. Remove lockwire and three headed straight pins and separate filter valve group from main filter.

(4) Remove lockwire, socket head cap screw, flat washer and spring tension clip. Then remove internal retaining ring and withdraw flow deflector from main filter.

B. Installation

(1) Insert flow deflector in filter and secure with internal retaining ring. Assemble spring tension clip and flat washer and retain with socket head cap screw. Torque 5 - 15 lb-in. Secure with 0.020 inch lockwire and dress out of flow stream per Figure 404.

(2) Install filter valve group in filter, piloting shaft into hole in center of flow deflector. Align holes in valve cap with holes in lugs of filter and retain filter valve group to main filter with three headed straight pins. Secure pins with 0.020 inch lockwire.

(3) Lubricate new preformed packings liberally with PWA 36500 Assembly Fluid. Install one packing on main filter and one packing on filter valve.

(4) Insert main filter and filter valve group into its bore in fuel control housing.

(5) Install two retaining rings and secure rings with flat washer and socket head cap screw. Torque screw 60 - 80 lb-in. Secure with 0.020 inch lockwire.

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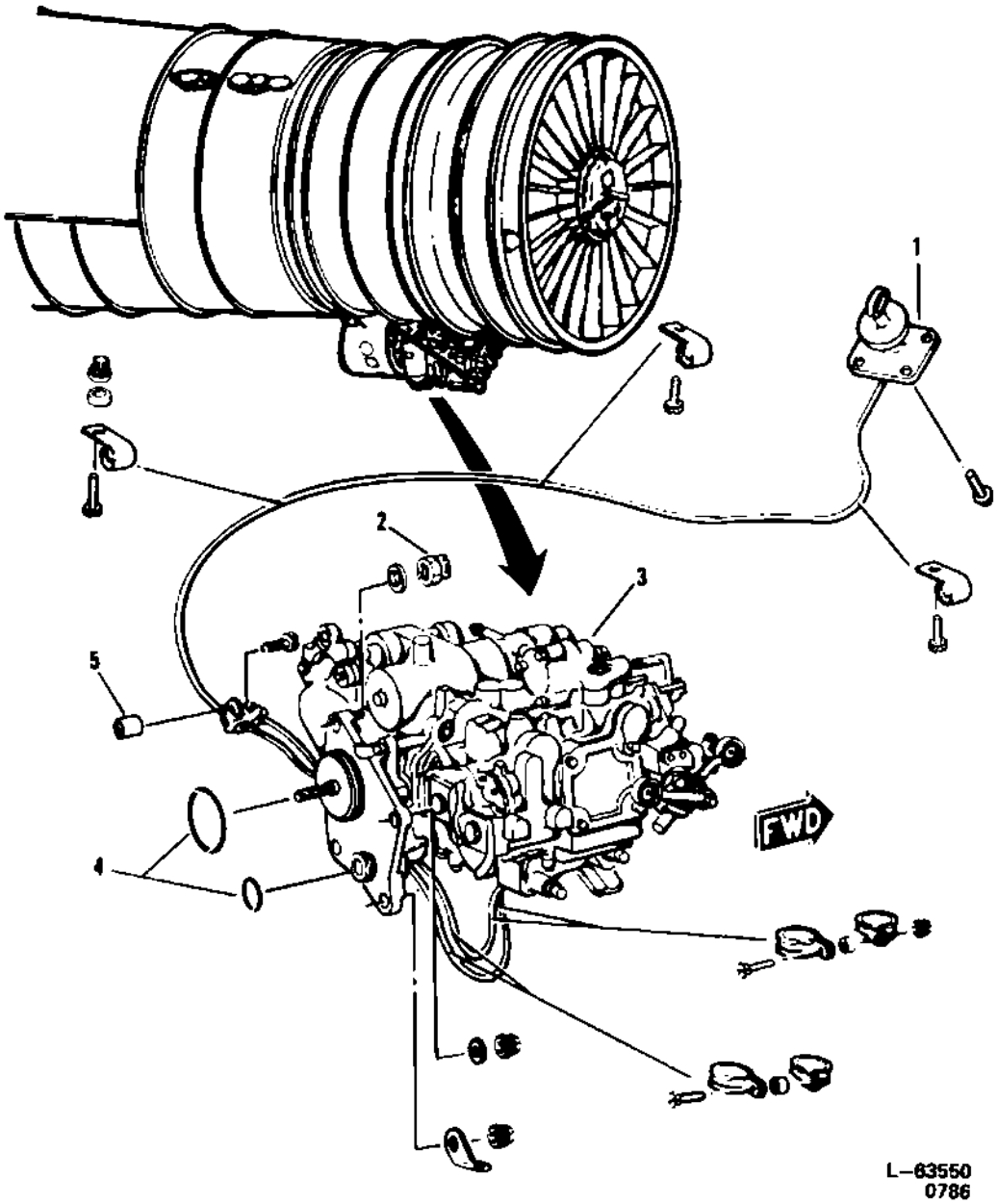
Task 73-21-01-990-001:

3. Tools

A. Special Tools

PWA 45246 Wrench Adapter



R Fuel Control Removal/Installation
R Figure 401 #73-21-01
(Task 73-21-01-990-001) REM/INST-00

1. Inlet Temperature Sensor
2. Use Wrench Adapter On This Locknut (See Text.)
3. Fuel Control
4. Packing
5. Spacer

Key to Figure 401

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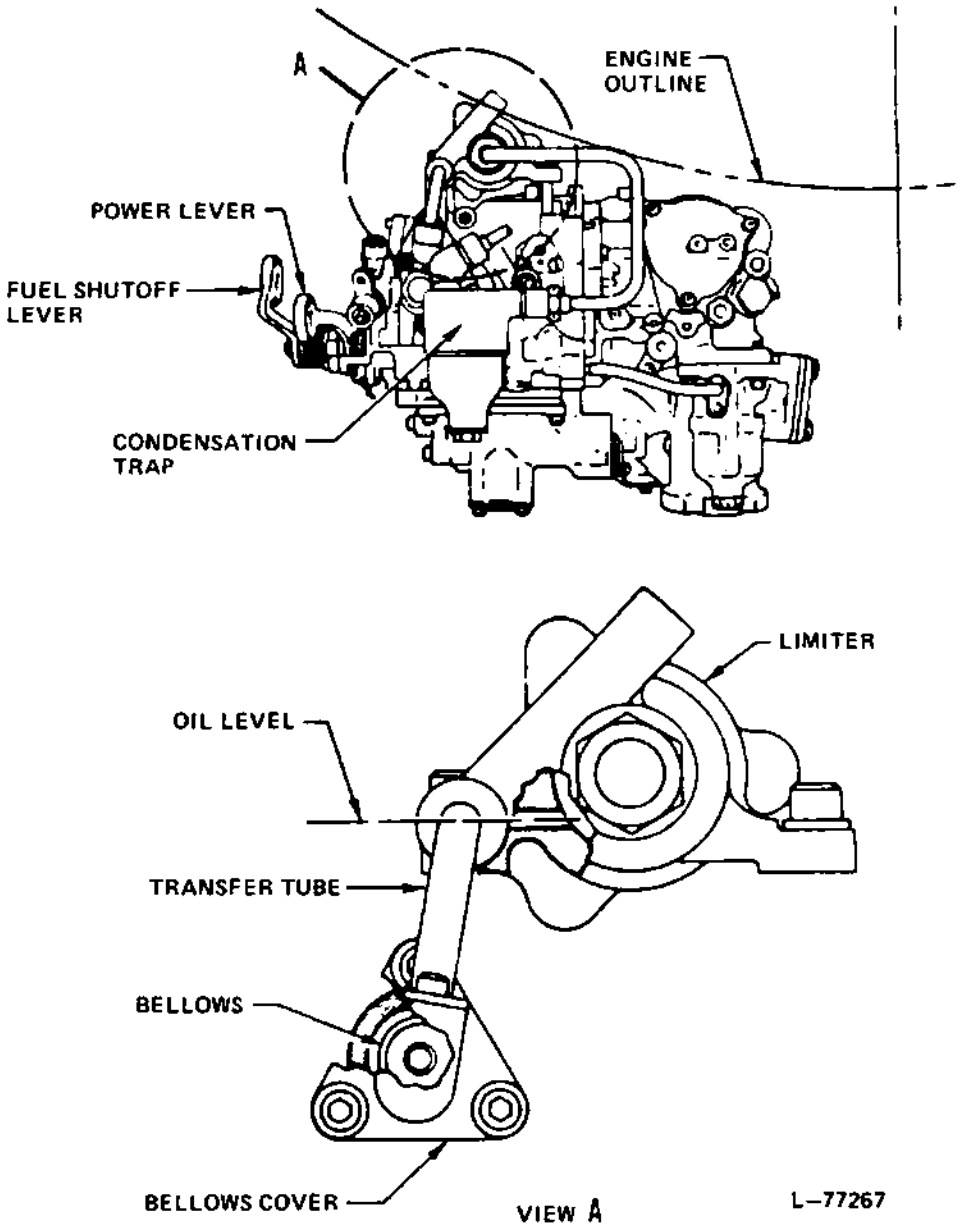
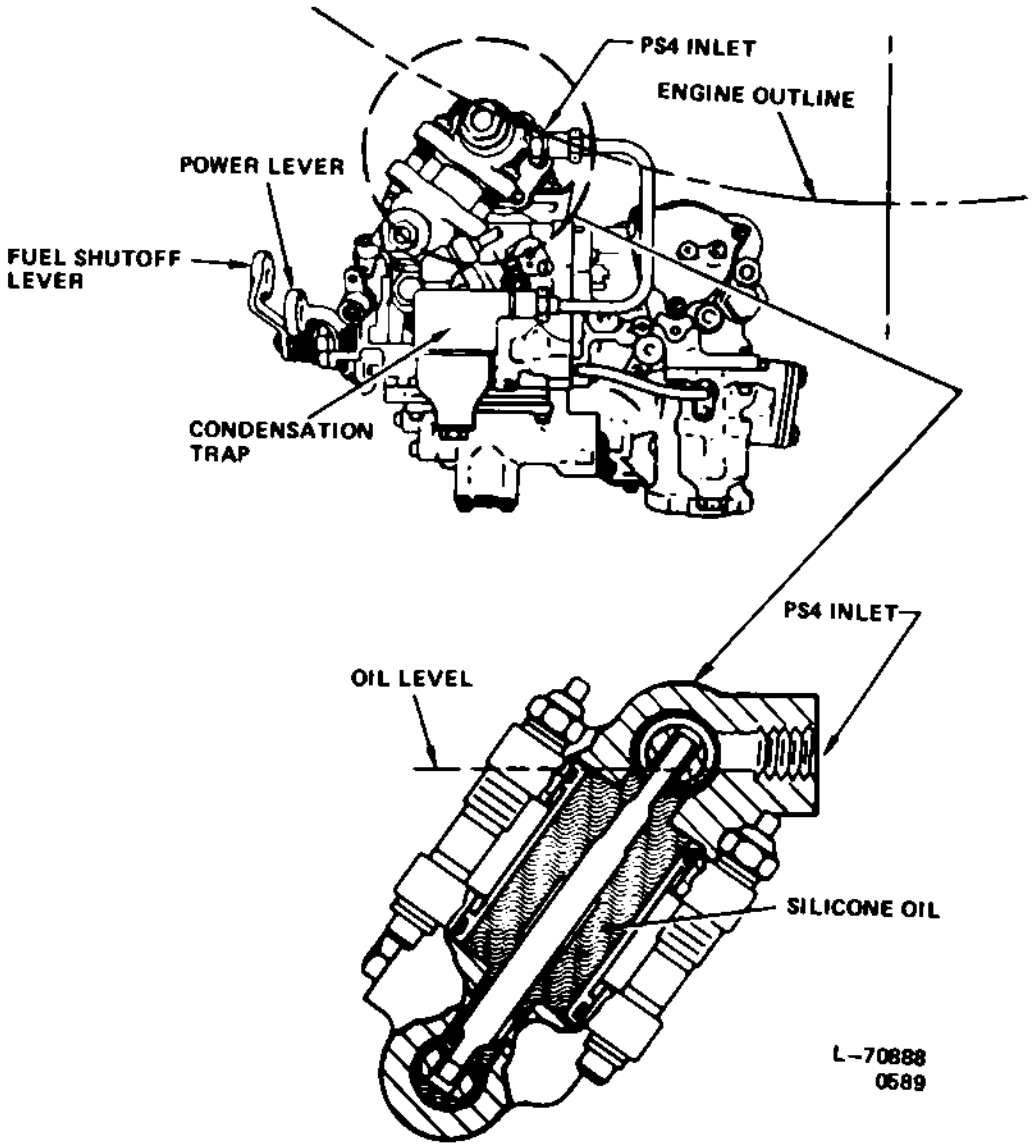


Burner Pressure Bellows Cavity
Oil Filling (Early Engines)
Figure 402 (Sheet 1)
(Task 73-21-01-990-001)



Burner Pressure Bellows Cavity
R Oil Filling (Later Engines)
R Figure 402 (Sheet 2)
(Task 73-21-01-990-001)

Task 73-21-01-110-001:

1. Cleaning of the Fuel Control Main Filter Group

A. Procedure

R (1) Cleaning

R NOTE: This procedure is deleted. Refer to Hamilton
R Sundstrand procedures for servicing of the fuel
R control filter.

FUEL CONTROL (JFC60-2/-3) - DESCRIPTION-00

Task 73-21-02-990-002:

1. Description and Operation of the Fuel Control

A. General

(1) The JFC60-2 or JFC60-3 fuel control having a sensorless pressure regulating valve is designed to schedule the fuel flow required by the engine to deliver the designed amount of thrust as dictated by the power lever position and the particular operating conditions of the engine. Two control levers are provided, one, the power lever, to control the engine during forward or reverse operation and the other, the shutoff lever, to effect engine shutdown and starting by closing and opening a fuel shutoff valve. The control accurately governs the engine steady state selected speed and regulates acceleration and deceleration fuel flows. The speed governing system is of the proportional or droop type.

(2) The fuel control consists of a metering and a computing system. The metering system selects the rate of fuel flow to be supplied to the engine burners in accordance with the amount of thrust demanded by the pilot, but subject to engine operating limitations as scheduled by the computing system as a result of its monitoring various engine operational parameters. The computing system senses and combines the various parameters to control the output of the metering section of the control during all regimes of engine operation.

B. Metering System

(1) High pressure fuel is supplied to the control from the engine drive fuel pump. This fuel is passed through the coarse filter which protects the metering system against large particles of fuel contaminants. Fuel going to the various servos is passed through a second filter of finer mesh which protects the computing system against solid contaminants. This fine filter is self-cleaning due to the presence of a flow deflector in the main flow stream which causes the flow velocity through the axis of the cylinder to be significantly greater than that of the flow through the mesh supplying the servo control valves. Both coarse and fine filter are protected by relief valves that open to allow fuel to bypass in the event the screens become clogged.

(2) The main fuel flow stream then flows to the metering valve (throttle valve) across which a constant pressure differential is maintained by the pressure regulating system. The throttle valve is a window type valve and is positioned by a half-area servo. This valve consists essentially of a fixed and a movable sleeve and an extension spring which is attached to the multiplying lever. The movable sleeve (piston) position is controlled by a rotating pilot valve which is displaced from its hydraulic null (steady-state) position by compressor discharge pressure, engine speed, compressor inlet temperature, power lever position, or any combination of these parameters. These actuating signals work in conjunction with each other to produce a net torque on the multiplying lever. A balancing torque is created by the throttle valve extension spring load varied with the valve position. As long as the resultant torque is zero, the throttle valve maintains a constant position. However, any change in the signal torque will displace the pilot valve and cause motion of the throttle valve piston until the unbalanced signal torque is balanced by the new throttle valve position and corresponding spring force. By virtue of the constant pressure drop maintained across the throttle valve, fuel flow is proportional to the position of the piston. The fuel flow rate for the full travel of the throttle valve is externally adjustable by rotation of the outer sleeve relative to the piston. An adjustable stop is provided which is preset for a specific maximum value of fuel flow. An adjustable stop is also provided to limit the motion of the piston in the decrease fuel flow direction to permit selection of the proper minimum fuel flow.

(3) In order for the control to ensure a predictable flow through the selected valve windown opening the pressure drop across the throttle valve is maintained at 40 psi (nominal) by a bypass type regulating valve. All high pressure fuel in excess of that required to maintain the pressure differential is bypassed to pump interstage. The bypass valve utilizes the impulse bucket principle to control the flow forces resulting from this bypass flow. The lower end of the pressure regulating valve is subjected to upstream throttle valve pressure. Balancing this on the upper side is a downstream throttle valve pressure nominally 40 psi lower than the lower end and a spring force equivalent to 40 psi. The valve bucket configuration is such

that changes in spring load are compensated by the flow forces, thus maintaining the 40 psi pressure drop across the throttle valve. Variations in fuel temperature are compensated for by the action of bimetallic discs working on the 40 psi (nominal) spring at the upper end of the valve. The pressure regulating valve is capable of bypassing 16,000 pounds per hour with a pressure drop across the bypass ports below 135 psi. This low pressure drop prevents the pump from operating against an excessively high head or causing large increases in fuel temperature.

(4) Fuel leaving the throttle valve passes through the minimum pressure and shutoff valve on its way to the engine. This valve is essentially a plunger type valve, spring loaded to the closed position, and is designed to shut off the flow of metered fuel to the engine when the pilot moves the shutoff lever to the "OFF" position. When actuated for the shutoff function high pressure is directed to the spring side of the valve by the action of the windmill bypass and shutoff valve. This pressure closes the valve and allows the spring to keep it in the shutoff position. When the shutoff lever is moved to the "ON" position, the high pressure on the spring side of the valve is replaced by pump interstage pressure and when metered fuel pressure has increased sufficiently to overcome the spring and interstage fuel pressure force, the valve opens and fuel flow to the engine is initiated. Thereafter, the valve will provide a minimum operating pressure within the fuel control, insuring that adequate pressure is always available for operation of the servos at low flow conditions.

(5) The windmill bypass and shutoff valve, in addition to supplying the high pressure signal for the shutoff function, also provides a windmill bypass feature. This valve is plumbed to a line leading to the spring side of the pressure regulating valve and is positioned by a shutoff lever operated cam so that signals are generated at the desired shutoff lever positions. Movement of the shutoff lever toward the shutoff position displaces the valve, thereby porting the pressure on the spring side of the pressure regulating valve to pump interstage. The pressure regulating valve now operates as a relief valve to handle the full windmilling fuel flow.

C. Computing System

(1) The computing system positions the throttle valve to control fuel flow during steady state operation, acceleration and deceleration by using the ratio of metered fuel flow to engine compressor discharge pressure (Wf/Ps4) as a control parameter.

(2) The positioning of the throttle valve by means of the Wf/Ps4 parameter is accomplished through a multiplying system whereby the Wf/Ps4 signal for acceleration, deceleration or steady state speed control is multiplied by a signal proportional to compressor discharge pressure to provide the required fuel flow.

(3) The compressor discharge pressure sensor assembly consists essentially of a pair of matched bellows, the evacuated and the motor bellows, and a sensor lever. The motor bellows is externally exposed to compressor discharge pressure and is referenced to an evacuated bellows of equal size to produce a resultant force which is proportional to absolute compressor discharge pressure. This force is transmitted through a sensor lever to a set of rollers whose position is proportional to the required Wf/Ps4 ratio. These rollers ride between the sensor lever and a multiplying lever. The force is transmitted through the rollers to the multiplying lever. Any change in the roller position or the compressor discharge pressure signal results in an unbalanced torque which will displace the rotating throttle valve pilot valve from its hydraulic null position, thereby repositioning the throttle valve. The movement of the throttle valve extends or relaxes the throttle valve feedback spring which will return the multiplying lever to its equilibrium position when the throttle valve reaches the required fuel flow position. Both the motor and evacuated bellows are located in a chamber vented through an orifice to ambient pressure so that in event of an evacuated bellows failure, the fuel flow error is only the difference between the flow required for the absolute pressure reading and that required for a gage pressure reading. In the event of a motor bellows failure, compressor discharge pressure will be sensed on the external surface of the evacuated bellows and the system will continue to function.

(4) The compressor discharge pressure limiter group consists of a clevis housing, spring housing, linear ball bearings, rolling diaphragm and piston, pushrod, two adjusting setscrews, transfer tube, limiter lever and spring, clevis support flexure and a bellows clevis rod. At values of Ps4 below the limiting pressure, the compressor discharge pressure limiter spring forces the diaphragm retainer against the pushrod housing. When Ps4 exceeds the limiting value, the spring force is overcome and the diaphragm retainer becomes unseated.

(5) The pushrod, which is attached to the diaphragm retainer, then engages the compressor discharge pressure limiter lever which in turn engages the compressor discharge pressure bellows stem clevis, thereby reducing the bellows output force.

(6) The speed sensing governor consists essentially of a rotating pilot valve, the flyweights and the flyweight head. The engine speed signal is transmitted from the engine driven drive shaft through a gear train to the centrifugal type flyweight governor. This governor controls movement of the speed servo (3-D cam) by displacing the rotating pilot valve from its hydraulic null position. When the speed changes, the flyweight force varies and the pilot valve is displaced causing motion of the speed servo. This motion of the speed servo repositions the pilot valve, through the action of a feedback lever working on a spring, until the speed sensing governor returns to null position at the new speed servo position. The position of the speed servo is, therefore, indicative of actual engine speed. The 3-D cam is contoured to protect against the condition of a broken speed sensing drive shaft. In the event of such a failure, the speed servo bottoms in its bore while the push rod on the speed servo bottoms on an adjustable stop set near the zero speed position to eliminate feedback to the speed governor pilot valve. The 3-D cam then places the limiting linkage at the Wf/Ps4 ratio corresponding to the value selected for this failure condition.

(7) Acceleration control is provided by adjustment of the roller positioning linkage to effect a maximum Wf/Ps4 ratio stop for a particular value of speed and compressor inlet temperature. The maximum Wf/Ps4 ratio value at the stop is controlled by a three dimensional (3-D) cam which is translated by a signal proportional to engine speed and rotated by a signal

proportional to compressor inlet temperature. The 3-D cam is so contoured as to define a schedule of Wf/Ps4 versus compressor inlet temperature which is used as a limiting value for each speed throughout the acceleration transient. This combination will permit engine acceleration within the over-temperature and surge limits of the engine. When the acceleration limiting lever is in operation to control the maximum value of the Wf/Ps4 ratio. it overrides the speed setting linkage.

(8) Deceleration control is provided by the constant radius portion of the droop cam and by adjustment of the roller positioning linkage to limit the travel of the rollers toward decreasing fuel flow, thereby effecting a minimum Wf/Ps4 ratio. This provides a linear relationship between fuel flow and compressor discharge pressure which results in blow-out free deceleration.

(9) Engine speed control is accomplished by comparing the actual speed, as indicated by the position of the speed servo, to the desired speed value required for the power selected by the pilot through a power lever positioning the speed set cam. The power lever actuates the speed set cam to select a governor droop line. The position of the droop line is biased by compressor inlet temperature. The deviation of desired speed from the actual speed (speed error) causes movement of the speed servo. This movement of the speed servo is transmitted through a lever and results in the repositioning of the droop cam. The rollers in the multiplication system are positioned through the action of the droop cam to be a function of the speed error. The repositioning of the rollers then provides the required steady-state Wf/Ps4 ratio setting.

(10) The temperature sensor bellows assembly consists of the motor and compensating bellows unit, a feedback lever, a pilot valve, and output lever and push rod, a compensating lever and push rod, and the temperature sensor housing. Compressor inlet temperature is sensed by a liquid filled bulb mounted in the compressor inlet and connected to a liquid filled bellows in the control. The liquid expands with increased temperature and the extra volume travels through a capillary tube to the liquid filled motor bellows in the control. The bellows length changes and through levers displaces a fourway pilot valve which results in movement of the temperature servo piston. The servo piston is

connected through a linkage to a rack which meshes with the spline on the 3-D cam and motion of the piston rotates the cam. The feedback lever is attached to the rack and as the rack moves to rotate the cam, it also repositions the pilot valve in order to return the valve to the steady-state position. The rotation of the 3-D cam, acting through a linkage, resets the governor droop and acceleration line. Any ambient air or fuel temperature variation which acts on the motor bellows and capillary tube also acts on a compensating bellows and dead-ended capillary tube causing the fixed pivot of the motor bellows lever system to move to a new position so that the net result of the variation is not sensed at the pilot valve.

D. Reserve Takeoff Thrust (RTT) System (JFC60-3 Fuel Control)

(1) The JFC60-3 fuel control features a Reserve Takeoff Thrust (RTT) system. This system senses power loss in other engines in aircraft at takeoff power and responds by opening a reset solenoid; this solenoid releases supply pressure to a servo piston which moves the 3-D cam to a higher thrust level, producing a higher takeoff power level.

(2) The pilot may override the automatic solenoid control feature and select the higher takeoff thrust by advancing the engine power lever beyond its normal takeoff position. This capability is a failsafe arrangement whereby Reserve Takeoff Thrust may be obtained when necessary in the event of failure of the electrical system or under emergency conditions where reduced engine power would not automatically signal RTT mode in other engines.

(3) For ground check purposes, a test contour on the 3-D cam makes it possible to select RTT mode at Ground Idle speed; a small but discernible speed change will indicate normal functioning of RTT system.

FUEL CONTROL (JFC60-2/-3) - REMOVAL/INSTALLATION-00

Task 73-21-02-450-001:

1. Removal/Installation of Fuel Control (Engines Having Sensorless Pressure Regulating Valve)

NOTE: See Chapter/Section 73-11-01, Removal/Installation-00 for alternate procedure.

A. Removal
See Figure 401.

(1) Disconnect the fuel control power lever linkage.

(2) Disconnect the fuel control rear Ps4 or Pb tube from the fuel control at the condensation trap. Remove the fuel control front Pb tube from between the condensation trap and fuel control limiter housing.

(3) Remove the fuel flowmeter inlet tube. Refer to Chapter/Section 73-15-01, Removal/Installation-00.

(4) Remove the inlet temperature bulb and lead from the inlet case.

NOTE: The inlet temperature bulb and lead are an integral part of the fuel control. Carefully coil the lead to avoid kinking and wrap the temperature bulb in protective paper.

(5) On JT8D-17R and -17AR engines, disconnect the electrical connections to the fuel control RTT actuating solenoid and indication switch.

(6) Provide support for the fuel control. Loosen and remove the nuts which secure the fuel control to the fuel pump. Separate the control from the pump.

NOTE: Remove the locknut shown in the figure. Use PWA 45246 Wrench Adapter for better access.

(7) Remove the condensation trap and fittings for transfer to the replacement control.

B. Installation
See Figures 401 and 402.

(1) Install the condensation trap and fittings on the fuel control.

NOTE: Do not install the connector in the limiter housing until the burner pressure bellows has been filled with oil (see paragraph C.).

(2) Install a new seal in the groove around the fuel control coupling shaft port.

(3) Install a new seal in the groove around the fuel control inlet port.

(4) Coat the fuel control shaft splines with engine oil.

CAUTION: EXTREME CARE MUST BE EXERCISED DURING INSTALLATION TO MAKE SURE THAT THE FUEL PUMP AND THE FUEL CONTROL SPLINES ARE POSITIVELY ENGAGED IN ORDER TO AVOID DAMAGE TO THE FUEL CONTROL DRIVE SHAFT BEARING. IF THE ENGINE IS STARTED WITH THE CONTROL ASSEMBLED INCORRECTLY, THE ENGINE WILL CONTINUE TO ACCELERATE WITH NO POWER LEVER RESPONSE. THIS MALFUNCTION RESULTS FROM A LACK OF ROTATION OF CONTROL DRIVE, CAUSING FLOW REGULATION ON A ZERO SPEED SCHEDULE ONLY. IF THIS PROBLEM OCCURS, THE CONTROL MUST BE REMOVED FOR DRIVE GEAR BEARING INSPECTION.

(5) Position control on pump. Install large nut and washer on top stud. Install three washers and three locknuts on remaining studs. Tighten locknuts to recommended torque.

NOTE: Install upper left locknut (see figure) using PWA 45246 Wrench Adapter (this tool has three-inch effective length). Attach standard 3/8 inch drive torque wrench to adapter.

(6) Install inlet temperature probe in inlet case and secure with bolts. Secure temperature cable with clips, spacers, grommets, bolts and nuts. Attach integral cable clip to Flange D with appropriate spacer and bolt. Torque and lockwire bolts.

(7) Install fuel flowmeter inlet tube per Chapter/Section 73-15-01, Removal/Installation-00.

(8) Connect fuel control rear Ps4 or Pb tube to fuel control condensation trap. Torque connection and lockwire.

(9) On JT8D-17R and -17AR engines, connect electrical line to fuel control RTT solenoid and indication switch.

(10) Adjust and install fuel control linkage arms per Chapter/ Section 72-60, Removal/Installation.

C. Procedure for Filling Burner Pressure Bellows (Hamilton Sundstrand No. 720050, 739666, 742522, 743602-1, 743602-2, 743602-3, 743602-4, 743602-5, 743522, 743522-1, 763603-1, and 763603-3) with Silicone Oil.

(1) Fill burner pressure bellows and limiter cavity completely to level of burner pressure inlet port opening on fuel control with silicone oil. See Figure 402.

NOTE: Care should be exercised to inject the oil downward into cylindrical portion of bellows cavity connecting upper and lower housing. Silicone oil is available as PRC Inc.'s Prosil 52 M-20 (to the mil spec Mil-S-81087) or Prosil 52 M-25 (to the commercial specification). These are available as Nyosil-M-20 and Nyosil-M-25 from PRC's distributor: Nye Lubricants P.O. Box 8927 New Bedford, MA USA 02742-8927 TEL: (508) 996-6721 FAX: (508) 997-5285

(2) Install connector (with new preformed packing) in limiter housing.

(3) Install fuel control front Pb tube between condensation trap and fuel control limiter housing. Torque connections and lockwire.

D. Engine Testing After Fuel Control Replacement

(1) Test engine by Chapter/Section 72-00-00, Adjustment/Test-01 after replacing fuel control.

NOTE: On Boeing 737 aircraft with Full Regime Auto-Throttle (FRAT), adjust Linear Variable Differential Transducer (LVDT) per Boeing Maintenance Manual, Autoflight Section Adjustment/Test.

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Task 73-21-02-450-002:

2. Removal/Installation of the Fuel Control Main Filter Group

NOTE: Main filter group includes fuel control main filter and servo fuel filter.

A. Removal

(1) Remove socket head capscrew and flat washer; then remove two retaining rings.

(2) Thread long shank bolt into hole in center of valve cap and, using bolt as puller, remove main filter and filter valve group.

(3) Remove preformed packing from valve cap and two preformed packings from filter. Remove lockwire and three headed straight pins and separate filter valve group from main filter.

(4) Remove lockwire, socket head cap screw, flat washer and spring tension clip. Then remove internal retaining ring and withdraw flow deflector from main filter.

B. Installation

(1) Install flow deflector into main filter and retain with internal retaining ring. Assemble spring tension clip and flat washer and retain with socket head cap screw. Torque 5 - 15 lb-in. Secure with 0.020 inch lockwire and dress out of flow stream per Figure 404.

(2) Install filter valve group into main filter, piloting shaft into hole in center of flow deflector. Align holes in valve cap with holes in lugs of main filter and retain with three headed straight pins. Secure pins with 0.020 inch lockwire.

R (3) Coat preformed packings with PWA 36500 lubricant and
R install them on the filter valve and main filter.

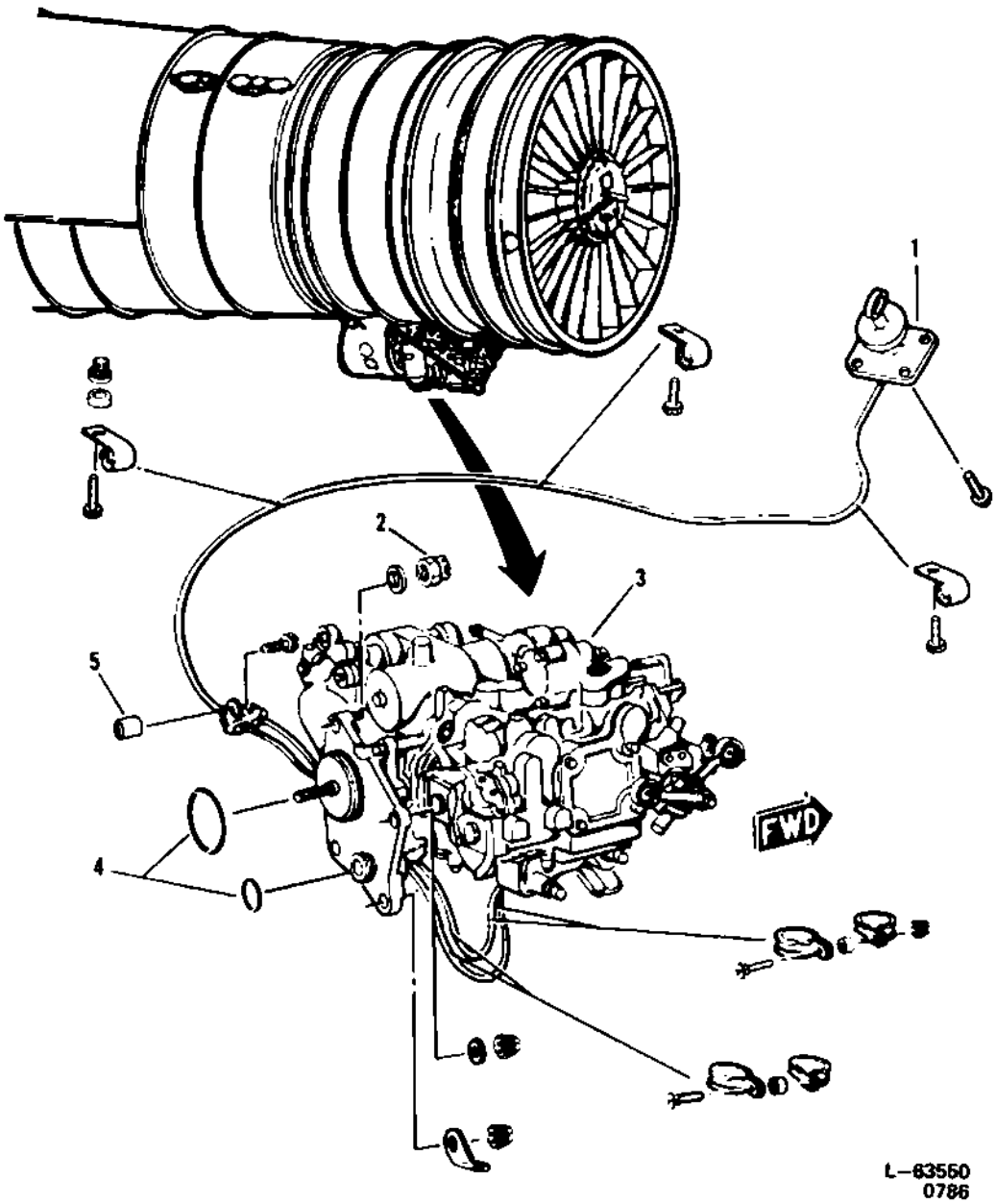
(4) Install main filter group into bore in hydraulic housing and retaining with two retaining rings, flat washer and socket head cap screw. Torque screw 60 - 80 lb-in. Secure with 0.020 inch lockwire.

Task 73-21-02-990-001:

3. Tools

A. Special Tools

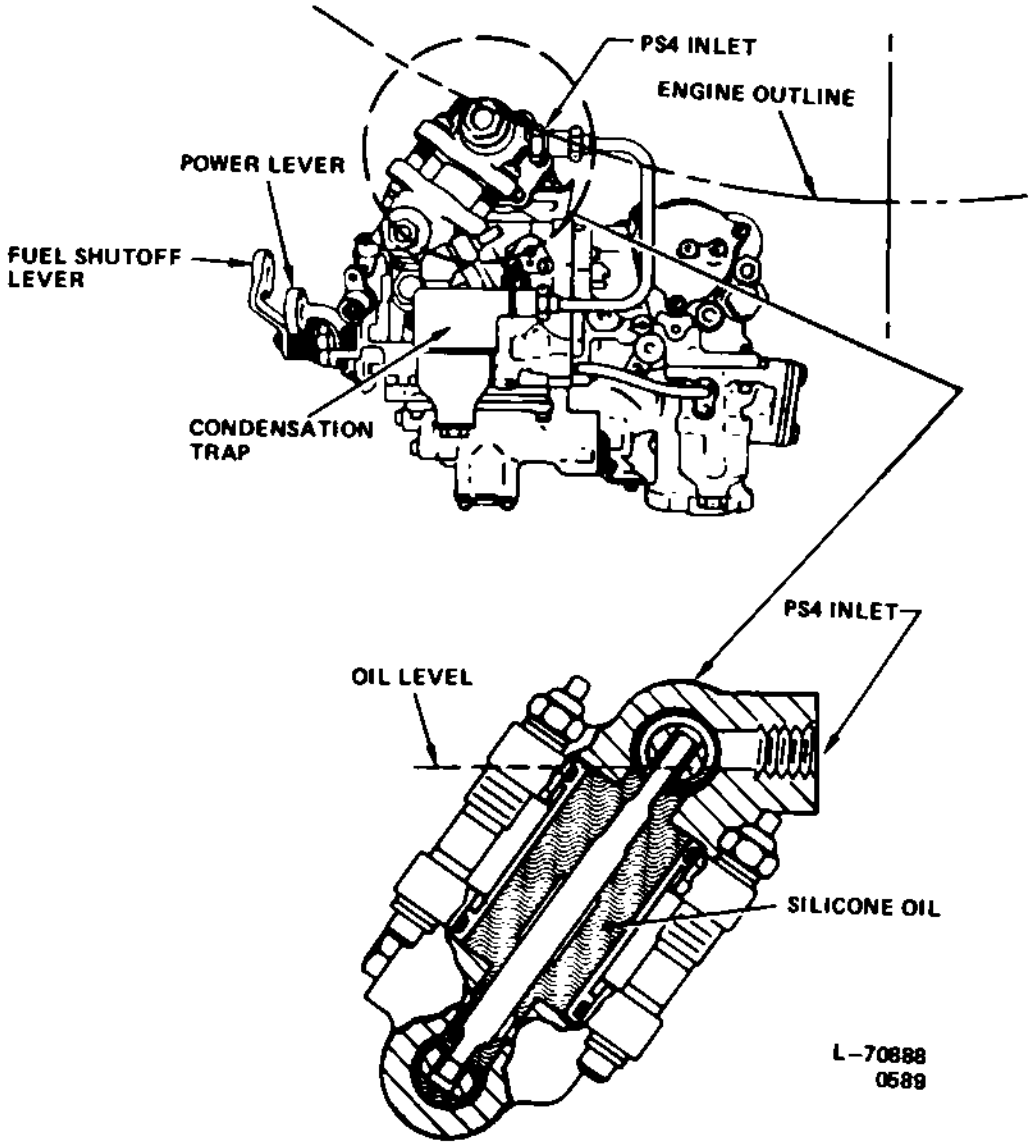
PWA 45246 Wrench Adapter



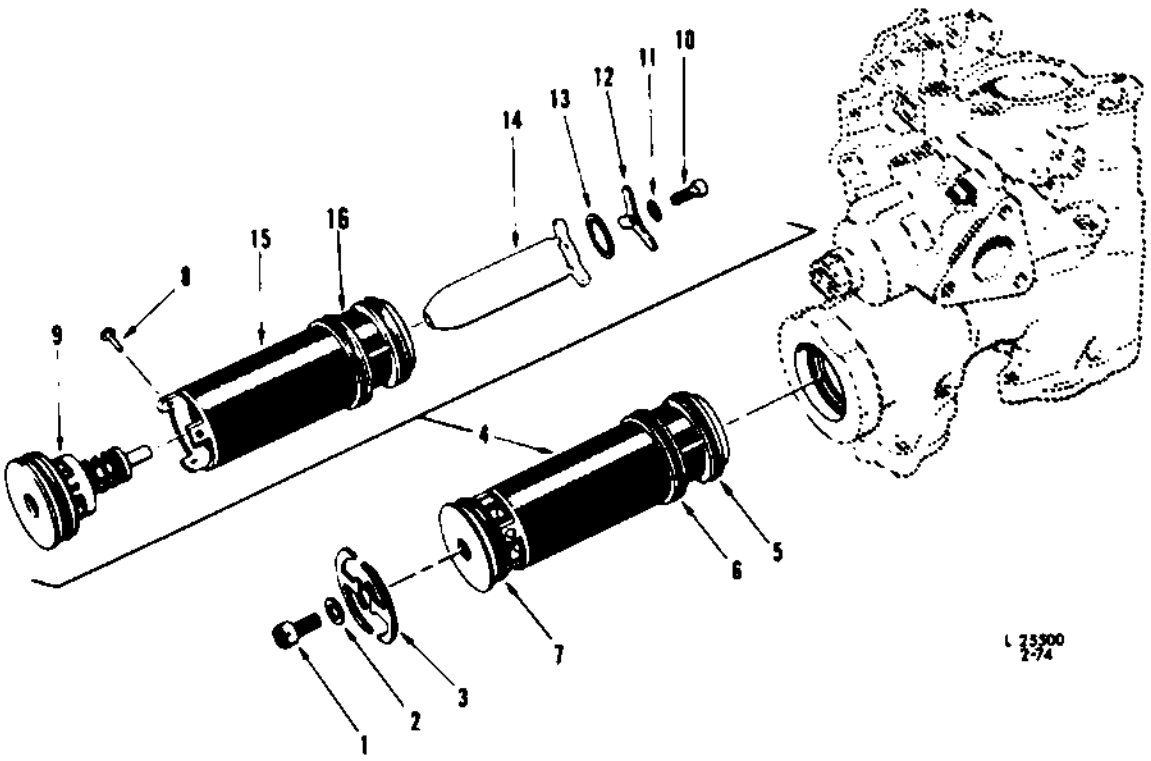
Fuel Control Removal/Installation
Figure 401
(Task 73-21-02-990-001)

1. Inlet Temperature Sensor
2. Use Wrench Adapter On This Locknut (See Text.)
3. Fuel Control
4. Packing
5. Spacer

Key to Figure 401

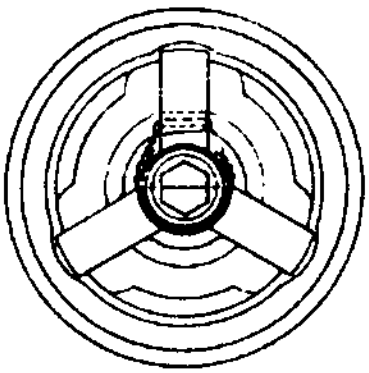


Burner Pressure Bellows
Cavity Oil Filling
Figure 402
(Task 73-21-02-990-001)



1. Socket Head Cap Screw
2. Flat Washer
3. Retaining Ring
4. Main Filter Group
5. Preformed Packing
6. Preformed Packing
7. Preformed Packing
8. Headed Straight Pin
9. Filter Valve Group
10. Socket Head Cap Screw
11. Flat Washer
12. Spring Tension Clip
13. Internal Retaining Ring
14. Flow Deflector
15. Main Filter
16. Servo Fuel Filter

Fuel Control Main Filter
Figure 403
(Task 73-21-02-990-001)



Lockwiring of Inlet Filter
Figure 404
(Task 73-21-02-990-001)

Task 73-21-02-110-001:

1. Cleaning of the Fuel Control Main Filter Group.

A. Procedure

R (1) Cleaning

R NOTE: This procedure is deleted. Refer to Hamilton
R Sundstrand procedures for servicing of the fuel
R control filter.

FUEL CONTROL PRESSURE SENSE LINE AND MOISTURE TRAP - DESCRIPTION-00

1. Descriptive Material On Fuel Control Ps4 Tube And Moisture Trap Formerly Contained In This Section Is Now Found In Chapter/Section 72-09-70, External Parts - Description.

FUEL CONTROL PRESSURE SENSE LINE AND MOISTURE TRAP - REMOVAL/INSTALLATION-00

1. See Chapter/Section 72-09-70, Removal/Installation For Procedures On Fuel Control Front And Rear Ps4 Tubes And On Ps4 Tube Moisture Trap.

74-00-00

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IGNITION SYSTEM - DESCRIPTION-00

Task 74-00-00-990-001:

1. Description

See Figure 1.

A. The ignition system initiates or sustains combustion of the fuel-air mixture in nine can-annular combustion chambers in the combustion section.

B. The 20-4 Joule continuous ignition system is powered by two input voltages (aircraft supplied) at the ignition exciter, 24 VDC and 115 V, 400 Hertz. The single unit housing incorporates one power input connection and two output
R connectors. The two output connectors supply high tension voltage through the exciter cables to the igniter plugs.

C. The 20 Joule twin-pack system (optional) is powered by 115 V, 400 Hertz voltage (aircraft supplied) at two ignition exciters. Each exciter incorporates one power input connector and one output connector. The output connectors supply high tension voltage through an exciter cable to the igniter plugs.

R D. An alternate 20-joule twin-pack continuous ignition system
R (post SB 5880) is powered by two input voltages (aircraft
R supplied) at the ignition exciter, 28 VDC and 115 V, 400
R Hertz. Each exciter has one power input connection and one
R output connector. The two output connectors supply high
R tension voltage through the exciter cables to the igniter
R plugs. See Sheet 2 of the figure.

E. The high tension voltage from the exciter ionizes the gap at the plug and the result is a spark of very high energy capable of igniting fuel.

Task 74-00-00-990-002:

2. Operation

A. For engines equipped with the single-pack 20-Joule DC system with spark splitter and continuous 4-Joule AC capability, the operational function is as follows:

(1) All ground starts or in-flight air starts must be made with the use of the 20-Joule DC exciter (firing both igniter plugs). For optimum life of ignition system

components, the operating duty cycle is 2 minutes ON, 3 minutes OFF, 2 minutes ON, 23 minutes OFF.

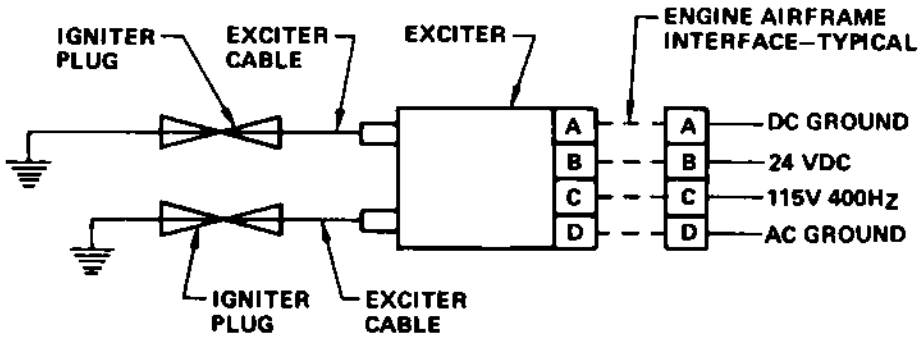
NOTE: If the 20-4 Joule single pack exciter unit has been operated beyond the recommended duty cycle, the unit must be removed and checked per overhaul instructions. The integrity of components within the exciter may have been compromised due to overheating. See Ignition Exciter - Removal/Installation. SB 5880 makes a dual unit continuous duty exciter available. This dual unit has no duty cycle limits, but refer to SB 5880 for periodic inspections necessary on other ignition components.

(2) For continuous operation, the 4-Joule system must be used in lieu of the 20-Joule DC system for protection against flameout during take-off and before activating the engine inlet anti-icing system. The 4-Joule system, which can be operated continuously may also be used for protection against flameout or at any other time deemed advisable, such as during periods of moderate or severe turbulence. To conserve the life of the ignition system components, the 4-Joule ignition system should be turned OFF during normal flight conditions whenever engine operation is stable.

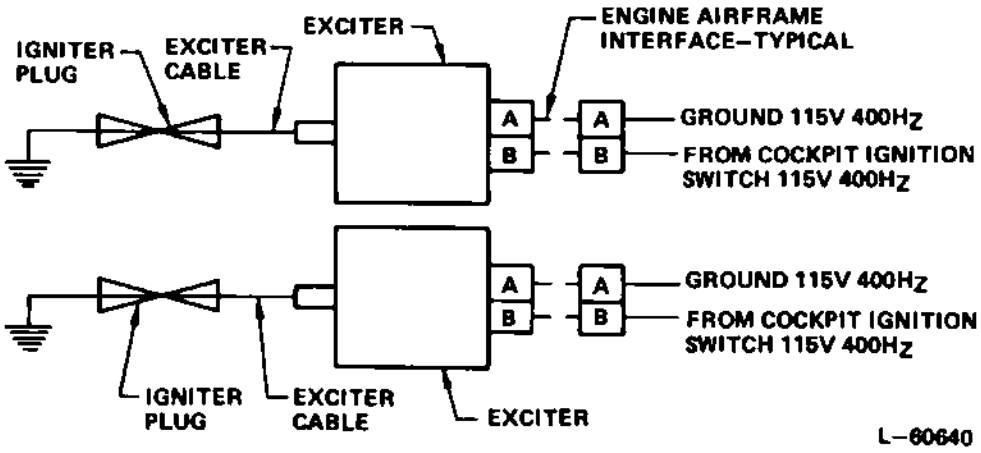
B. For engines equipped with the twin-pack 20-Joule AC system, ground starts can be made with the use of only one of the two ignition systems. Pratt and Whitney recommends that both ignition systems be used for ground starts and air starts. Using both ignition systems during a start ensures better flame propagation which in turn, results in rapid, dependable starting. For optimum life of ignition system components, the operating duty cycle is 10 minutes ON, 20 minutes OFF.

NOTE: SB 5803 makes a continuous duty dual unit available. This dual unit has no duty cycle limits, but refer to SB 5803 for periodic inspections necessary on other ignition components.

R
R

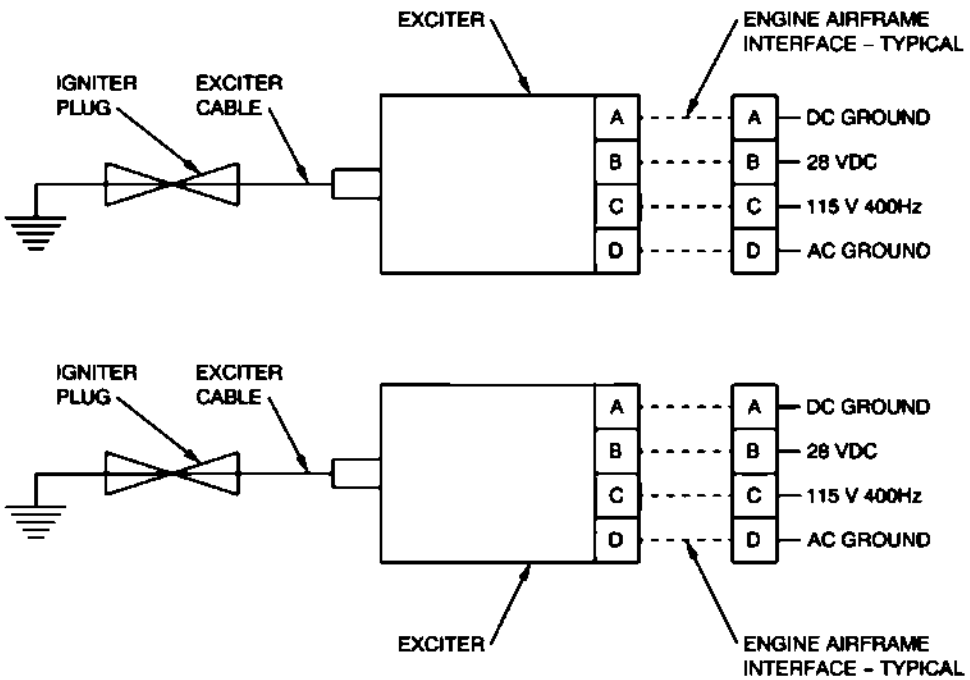


20–4 JOULE DC STARTING AND CONTINUOUS IGNITION SYSTEM



20 JOULE AC TWIN PACK IGNITION SYSTEM (OPTIONAL)

R Ignition System Schematic
R (Single Pack Continuous And
R Twin Pack Intermittent)
Figure 1 (Sheet 1)
(Task 74-00-00-990-002)



TWIN AC/DC CONTINUOUS IGNITION SYSTEM

L-H8471 (1209)
PW V

R Ignition System Schematic
R (Twin Pack Continuous)
R Figure 1 (Sheet 2)
R (Task 74-00-00-990-002)

IGNITION SYSTEM - TROUBLESHOOTING-00

Task 74-00-00-810-001:

1. General See Chapter/Section 72-00-00, Troubleshooting-01 For Fault Isolation Procedures On The Ignition System

Task 74-00-00-210-001:

1. Functional Check

NOTE: This test consists of an audible check for sparking of the igniter plugs when the ignition system is energized. In the event sparking is not heard in operating mode which should produce it, various components of the ignition system (exciter, leads, plugs) must be checked or replaced to isolate the cause of malfunction.

A. Test Procedure

CAUTION: BEFORE YOU BEGIN THIS TEST, BE CERTAIN TO CLEAR THE ENGINE OF ANY TRAPPED FUEL OR FUEL VAPOR AS DIRECTED, TO AVOID A FIRE HAZARD.

(1) Do "Clear Engine Procedure" in Chapter/Section 72-00-00, Adjustment/Test-01 to purge residual fuel from the combustion section. Make sure that the fuel shutoff lever is in the OFF position and that the rotors have stopped turning before you begin the ignition check.

WARNING: TAKE PROPER PRECAUTIONS AROUND ELEMENTS OF THE IGNITION SYSTEM TO PREVENT PERSONAL INJURY. DO NOT TOUCH IGNITION LEAD CONNECTIONS WHILE THE TEST IS IN PROGRESS.

(2) Turn the ignition circuit on for the engine being checked and listen for spark noises at the right and left igniter plug positions.

(a) With 20-Joule Intermittent/4-Joule Continuous Duty ignition exciter, use the cockpit controls to test the intermittent (ground start) and continuous duty circuits separately.

NOTE: In intermittent-duty mode both igniter plugs should fire; listen for a spark noise at each side of the engine. In continuous-duty mode, only the left-hand igniter plug will fire.

(b) With 20-Joule Twin-Pack ignition exciter, test each circuit separately to verify that each igniter plug is firing.

WARNING: IGNITION SYSTEM VOLTAGE IS DANGEROUSLY HIGH. THE IGNITION SWITCH MUST BE IN THE "OFF" POSITION BEFORE YOU REMOVE ANY IGNITION COMPONENTS. ALLOW SEVERAL MINUTES TO ELAPSE BETWEEN OPERATION OF THE IGNITION SYSTEM AND THE REMOVAL OF IGNITION COMPONENTS. IMMEDIATELY AFTER YOU DETACH THE IGNITER CABLE FROM THE IGNITER PLUG, DISCHARGE THE CURRENT BY GROUNDING THE IGNITER CABLE TERMINAL TO MAKE SURE THE ENERGY FROM THE IGNITION SYSTEM COMPLETELY DISSIPATES. FAILURE TO FOLLOW THIS PROCEDURE COULD RESULT IN SEVERE INJURY TO PERSONNEL.

(3) Turn the ignition circuit off and do any checks of the ignition system components and connections which may be indicated.

Task 74-00-00-220-001:

1. Ignition System Inspection

WARNING: IGNITION SYSTEM VOLTAGE IS DANGEROUSLY HIGH. THE IGNITION SWITCH MUST BE IN THE "OFF" POSITION BEFORE YOU REMOVE ANY IGNITION COMPONENTS. ALLOW SEVERAL MINUTES TO ELAPSE BETWEEN OPERATION OF THE IGNITION SYSTEM AND THE REMOVAL OF IGNITION COMPONENTS. IMMEDIATELY AFTER YOU DETACH THE IGNITER CABLE FROM THE IGNITER PLUG, DISCHARGE THE CURRENT BY GROUNDING THE IGNITER CABLE TERMINAL TO MAKE SURE THE ENERGY FROM THE IGNITION SYSTEM IS COMPLETE DISSIPATED. FAILURE TO FOLLOW THIS PROCEDURE COULD RESULT IN SEVERE INJURY TO PERSONNEL.

A. General

(1) The following inspection procedures are a normal function of operating organizations. The nature and conditions of engine operation determines the time interval between required inspections.

NOTE: If the 20-4 Joule single pack exciter unit has been operated beyond the recommended duty cycle, the unit must be removed and checked per overhaul instructions. The integrity of components within the exciter may have been compromised due to overheating. See Chapter/Section 74-11-01, Removal/Installation-00. SB 5880 makes a dual unit continuous duty exciter available. This dual unit has no duty cycle limits, but refer to SB 5880 for periodic inspections necessary on other ignition components.

B. Procedure

(1) Inspect the ignition system for security of components and wire braid fraying.

(2) Inspect the ignition exciter terminal well for arcing and tracking. See Section 74-11-01, Inspection/Check-00.

(3) Inspect the exciter-to-igniter plug cable terminal ends for arcing and tracking. See Section 74-21-01, Inspection/Check-00.

(4) Inspect igniter plug terminal well and tip erosion. See Section 74-22-01, Inspection/Check-00.

C. Rapid Shutdown.

(1) Whenever an engine is rapidly shut down, the ignition system may not be sufficiently cooled. Inspect the cables, particularly at the igniter plug terminal, to make sure that excessive temperatures did not affect lead insulation that will result in arcing and carbon tracking. See Section 74-21-01, Inspection/Check-00.

D. Troubleshooting.

(1) See Chapter/Section 72-00-00, Troubleshooting-01.

Pratt & Whitney
JT8D MAINTENANCE MANUAL (PN 481671)

Please insert the revised pages into this manual and delete obsoleted pages in accordance with the following List of Effective Pages. Revised pages are indicated by the letter "R", added pages by the letter "A", and deleted pages by the letter "D". Superseded pages shall be removed and destroyed.

The List of Effective Pages records not only each page of subject revision but also each previously issued page which is still current. Blank pages and pages which are no longer current do not appear on this list. If there is any question about the currency of the maintained copy, it is recommended that each page of the manual be checked off against this List of Effective Pages. Any page which does not check out with this list, either by number or by date, shall be discarded. This list is reissued in its entirety whenever this manual section is revised.

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74 - IGNITION

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IGNITION EXCITER (SINGLE PACK) - DESCRIPTION-00

Task 74-11-01-990-001:

1. 20-4 Joule Ignition Exciter (Single Pack) - Description

See Figure 1.

A. The 20-4 Joule ignition exciter is a capacitor discharge system designed to provide ignition for the JT8D Turbofan Engine. This ignition exciter serves the dual purpose of providing intermittent duty starting ignition and continuous duty ignition which are used as required after starting. Two different input voltages are required for the exciter. Both circuits of the ignition exciter are contained in one compact housing with one input power connection and two output connections. (Post SB 5880 these circuits are in a dual unit See the description below).

Task 74-11-01-990-002:

2. 20-4 Joule Ignition Exciter (Single Pack) - Operation

See Figure 2.

A. The intermittent duty starting circuit requires an input of 24 VDC nominal while the continuous duty circuit requires an input of 115 VAC 400 Hertz. The intermittent duty starting circuit discharges through both outlets, firing two igniter plugs. The continuous duty circuit discharges only through the outlet marked CONTINUOUS DUTY OUTLET, firing one igniter plug. Spark gaps prevent current from flowing in one circuit when the other circuit is in operation.

B. The exciter design is repairable using test equipment available in most airline overhaul shops. Positive hermetic seal is assured through use of a stainless steel case weldment. The exciter capability for continuous operation will assure conformance with potential airline ignition duty cycles. Maximum exciter service life can, however, be attained by ignition utilization per recommended engine/or aircraft operational procedures.

Task 74-11-01-990-003:

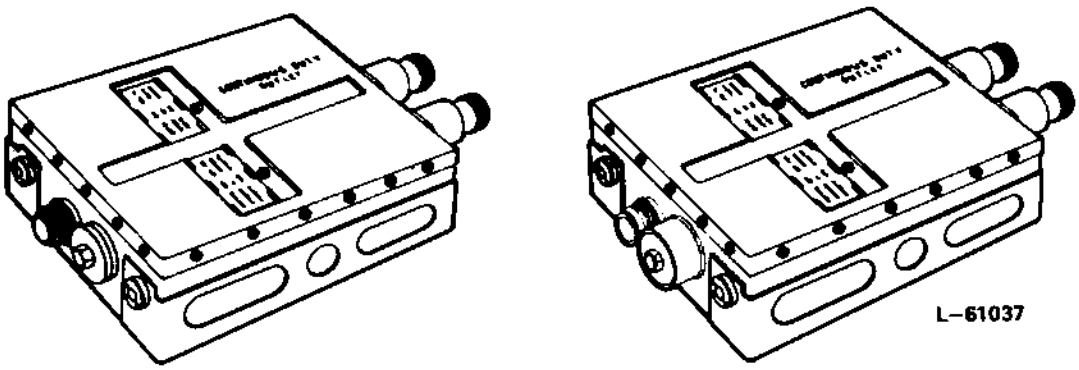
3. 20-4 Joule Ignition Exciter (Dual Unit) - Operation

A. SB 5880 makes a continuous duty ignition exciter available as a dual unit ("twin-pack"). This dual unit operates in the same way as the single unit but has two input connections (one for each unit). A one-into-two cable is provided to connect this dual unit to existing electrical supplies.

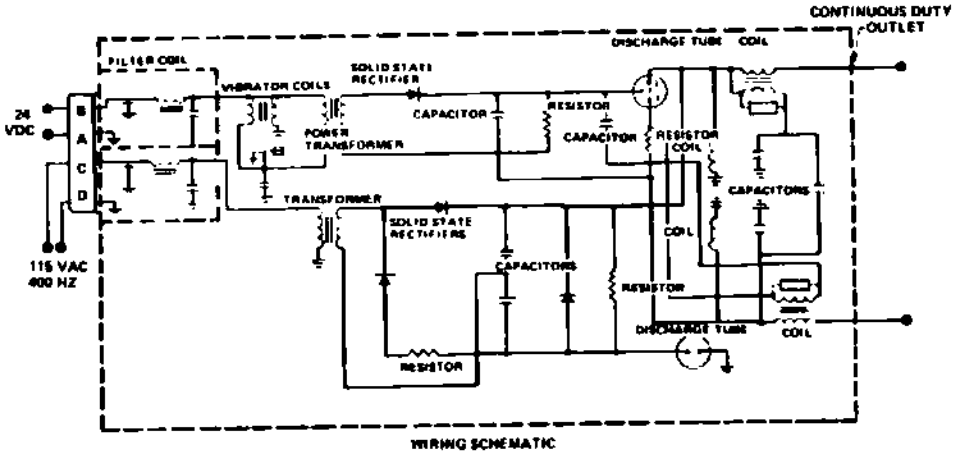
Table of Leading Particulars

	INTERMITTENT DUTY CIRCUIT	CONTINUOUS DUTY CIRCUIT
Input Connector Pins	"B" Positive, "A" Ground	"C" Positive, "D" Ground
Input Voltage	14 to 30 VDC	90 to 124 VAC 350 to 440 GPS
Input Current	5.1 Amp DC Max.	2.5 Amps RMS Max.
Duty Cycle	Intermittent	Continuous
Number of Plugs Fired	2	1
Stored Energy	20 Joules	4 Joules
Spark Rate	0.5 $/$ Minimum	0.7 $/$ Minimum
Ionizing Voltage	22-26 KV	22-26 KV
Ambient Temperature	-65°F to 275°F	
Operating Altitude	70,000 ft. max.	

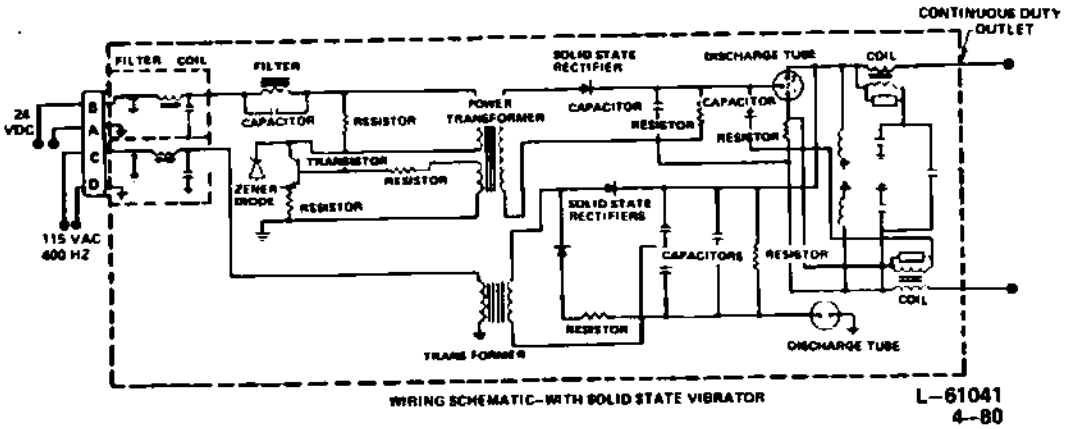
IGNITION EXCITER (SINGLE PACK) - DESCRIPTION-00



Ignition Exciters (20-4 Joule)
Figure 1
(Task 74-11-01-990-003)



WIRING SCHEMATIC



WIRING SCHEMATIC–WITH SOLID STATE VIBRATOR

L–61041
4–80

Ignition Exciter Wiring Schematic
Figure 2
(Task 74-11-01-990-003)

IGNITION EXCITER (SINGLE PACK) - REMOVAL/INSTALLATION-00

Task 74-11-01-450-001:

1. Removal/Installation of Ignition Exciter - Bendix/Unison 20-4 Joule

See Figures 401 thru 403.

A. Removal

WARNING: IGNITION SYSTEM VOLTAGE IS DANGEROUSLY HIGH. THE IGNITION SWITCH MUST BE IN THE "OFF" POSITION BEFORE YOU REMOVE ANY IGNITION COMPONENTS. ALLOW SEVERAL MINUTES TO ELAPSE BETWEEN OPERATION OF THE IGNITION SYSTEM AND THE REMOVAL OF IGNITION COMPONENTS. IMMEDIATELY AFTER YOU DETACH THE IGNITER CABLE FROM THE IGNITER PLUG, DISCHARGE THE CURRENT BY GROUNDING THE IGNITER CABLE TERMINAL TO MAKE SURE THE ENERGY FROM IGNITION SYSTEM IS COMPLETELY DISSIPATED. FAILURE TO FOLLOW THIS PROCEDURE COULD RESULT IN SEVERE INJURY TO PERSONNEL.

(1) Disconnect the ignition cables from the left and right igniter plugs and touch each cable electrode to a good engine ground.

(2) Disconnect the coupling nuts that attach the ignition cables to the output connectors on the rear of the exciter.

(3) Install protective caps on the coupling nuts of cables and on the mating threaded output connectors on the exciter.

(4) Disconnect the airframe input cable.

(a) Single unit (Pre SB 5880): Disconnect the airframe input cable from the input connector on the front of the ignition exciter. Put caps or covers on the cable and connector to prevent damage.

(b) Dual unit (Post SB 5880): Disconnect each of the input connections from the two exciter units. Put caps or covers on the cable ends and exciter connectors to prevent damage.

NOTE: It is not necessary to disconnect the airframe input cable from the exciter cable at the Flange J bracket.

(5) Cut the lockwire and remove the four bolts and washers which attach the ignition exciter to the front and rear supports.

(6) Spread the front and rear supports and remove the exciter, input (front) end first.

(7) If the ignition exciter is a dual unit (Post SB 5880), do the steps that follow:

(a) Remove the bolts and nuts that attach the two exciter units.

(b) Remove one unit from the other.

B. Installation

(1) If the ignition exciter is a dual unit (Post SB 5880), do the steps that follow:

(a) Put the exciter units on a bench with the larger connectors (outputs) at the operator's right.

(b) Attach the units with two bolts and nuts at each end (put the bolt heads against the upper exciter as shown in Figure 401).

(c) Torque the bolts to the recommended torque.

(2) Spread the front and rear ignition exciter supports and install the ignition exciter between the supports, output (rear) end first.

CAUTION: DO NOT USE BOLTS LONGER THAN THOSE SPECIFIED FOR IGNITION EXCITER MOUNTING. THIS WILL RESULT IN DAMAGE TO THE IGNITION EXCITER HOUSING, WITH SUBSEQUENT LOSS OF HERMETIC SEALING AND RISK OF ELECTRICAL GROUNDING.

(3) Attach the ignition exciter to the supports with four bolts and washers. Torque the bolts and lockwire.

CAUTION: MAKE SURE THAT THE OUTPUT (HIGH TENSION) LEADS ARE CORRECTLY INSTALLED. INSUFFICIENT TORQUE ON THE LEAD NUTS AT THE EXCITER AND IGNITER ENDS CAN CAUSE IGNITION-RADIATED NOISE WHICH CAN BE PICKED UP BY AIRCRAFT RADIO EQUIPMENT.

(4) Remove protective caps from the coupling nuts on the ignition cables.

(5) Replacement of high tension lead rubber bushings (chamfer washers) (Bendix/Unison cables). See Figure 402.

NOTE: The bushing (chamfer washer) replacement procedure is not applicable for new cable assemblies. Do an inspection of the cable during bushing (chamfer washer) replacement. Either Bendix/Unison or Simmonds cables can be used interchangeably with a Bendix/Unison ignition exciter. See this paragraph or following paragraph as applicable.

WARNING: IGNITION CABLE RUBBER BUSHINGS (CHAMFER WASHERS) AND ADJACENT PARTS MAY CONTAIN RESIDUE OF KRYTOX 240 AC GREASE. DO NOT CONTAMINATE SMOKING MATERIALS (CIGARETTES, CIGARS, ETC.) WITH KRYTOX 240 AC GREASE. COMBUSTION PRODUCTS OF KRYTOX 240 AC GREASE COULD BE HARMFUL IF INHALED. AVOID SKIN CONTACT. WASH YOUR HANDS IMMEDIATELY AFTER CONTACT WITH KRYTOX 240 AC GREASE. THIS GREASE IS NO LONGER USED ON JT8D IGNITION CABLES.

(a) Remove and discard the rubber bushing (chamfer washer) at both ends of cable.

NOTE: Bendix/Unison bushings (chamfer washers) are not available from Pratt & Whitney.

See Illustrated Parts Catalog PN 481675 for part numbers and vendor sources for availability.

(b) Slide a new bushing (chamfer washer) in place on the high tension insulator (5).

NOTE: Do not put grease on the insulator or on other details of the cable.

(6) Replacement of high tension lead rubber bushings (Simmonds/ BF Goodrich/Unison Industries cables). See Figure 403.

NOTE: The bushing replacement procedure is not applicable for new cable assemblies. Do an inspection of the cable during bushing replacement. Either Bendix/Unison or Simmonds cables can be used interchangeably with a Bendix/Unison ignition exciter. See this paragraph or previous paragraph as applicable.

WARNING: IGNITION CABLE RUBBER BUSHINGS AND ADJACENT PARTS MAY CONTAIN RESIDUE OF KRYTOX 240 AC GREASE. DO NOT CONTAMINATE SMOKING MATERIALS (CIGARETTES, CIGARS, ETC.) WITH KRYTOX 240 AC GREASE. COMBUSTION PRODUCTS OF KRYTOX 240 AC GREASE COULD BE HARMFUL IF INHALED. AVOID SKIN CONTACT. WASH YOUR HANDS IMMEDIATELY AFTER CONTACT WITH KRYTOX 240 AC GREASE. THIS GREASE IS NO LONGER USED ON JT8D IGNITION CABLES.

(a) Remove and discard the retaining ring (6) from the high tension contact (5).

(b) Slide the high tension insulator (4), rubber bushing (3) and if applicable, Post SB 6246 rubber sealing washer (8) from the cable wire (2). Discard the rubber bushing(s).

NOTE: The retaining ring (6), rubber bushing (3) and Post SB 6246 rubber sealing washer are not available from Pratt & Whitney. See Illustrated Parts Catalog, PN 481675 for part numbers and vendor sources for availability.

(c) Slide the rubber bushing (3), the high tension insulator (4) and if applicable, Post SB 6246 rubber sealing washer on the cable wire (2) and tighten it in place with a new retaining ring (6) on the high tension contact (5).

NOTE: Do not put grease on the insulator or on other details of the cable.

(7) Attach the ignition cable coupling nuts to the output connectors on the rear of the exciter. Tighten the nuts fingertight, then tighten them 45 degrees more maximum. See Chapter/Section 72-00-00, Inspection/Check-02, "External Parts Fits and Clearances", Reference 113.

(8) Connect the igniter cables to the left and right igniter plugs. Refer to Chapter/Section 74-21-01, Removal/Installation-00).

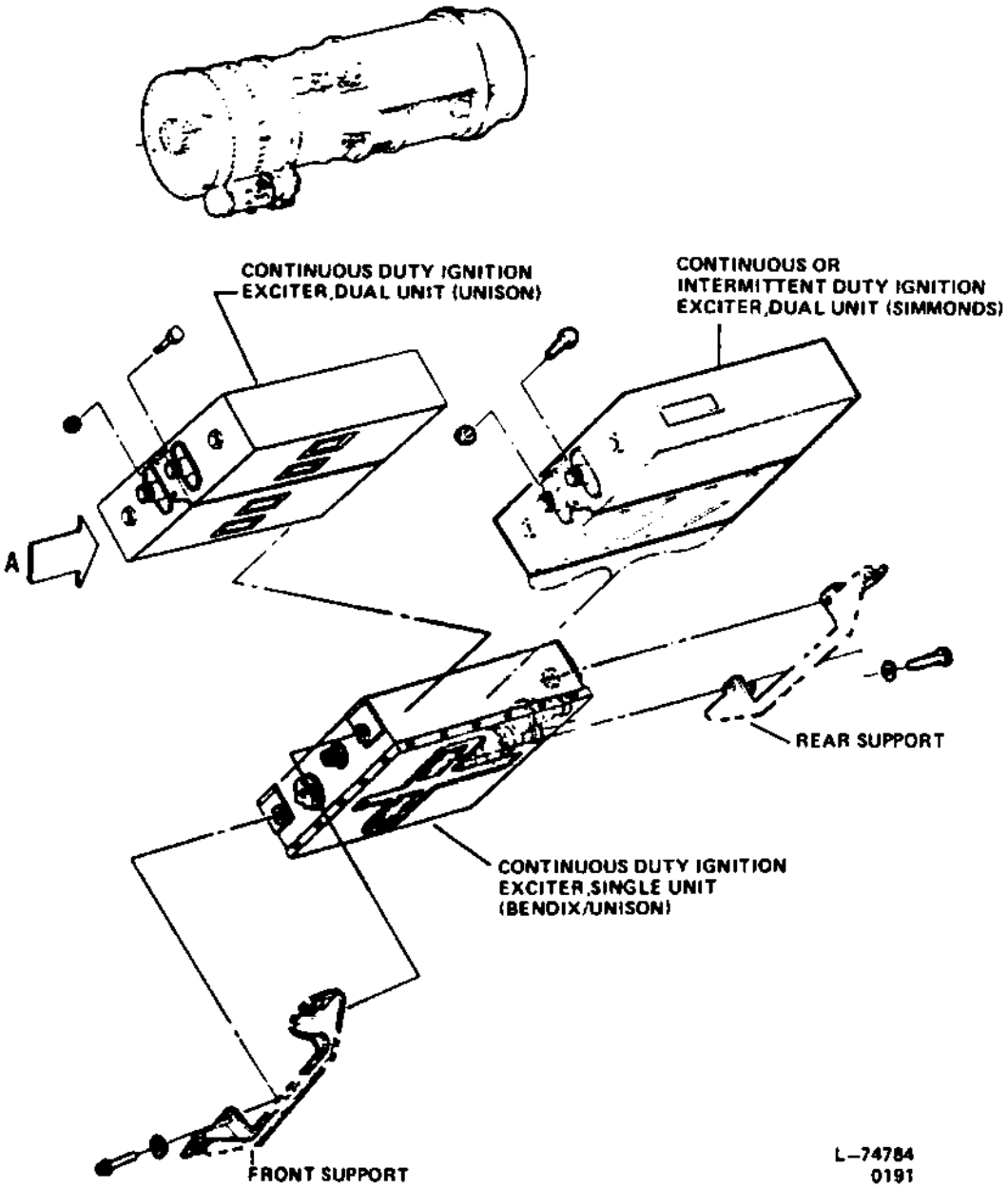
(9) Connect the airframe input cable.

(a) Single unit (Pre SB 5880): Remove the caps and covers and connect the cable coupling nut to the input connector on the front of the exciter. Tighten the nut to the recommended torque.

(b) Dual unit (Post SB 5880): Remove the caps and covers and connect the two cable connections to each of the input connectors on the front of the exciter. Tighten the nuts to the recommended torque. See (Sheet 2) of Figure 401.

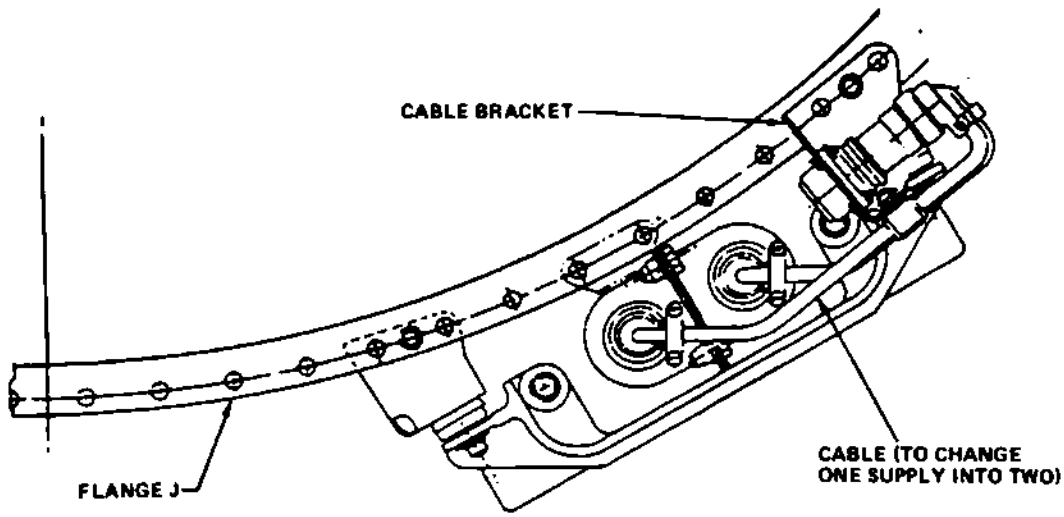
NOTE: Make sure the airframe input cable is connected to the cable at the Flange J bracket.

IGNITION EXCITER (SINGLE PACK) - REMOVAL/INSTALLATION-00



Ignition Exciter
Removal/Installation
Figure 401 (Sheet 1)
(Task 74-11-01-450-001)

IGNITION EXCITER (SINGLE PACK) - REMOVAL/INSTALLATION-00

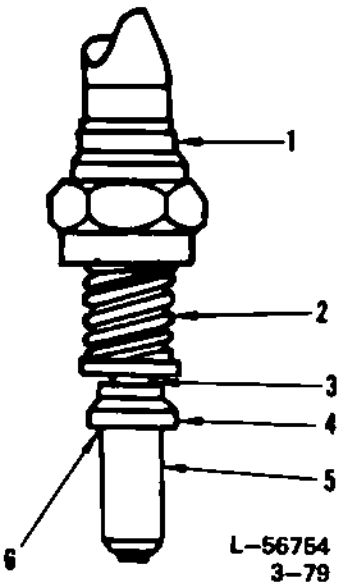


VIEW IN DIRECTION A
(UNISON DUAL UNIT ONLY)

L-H0470

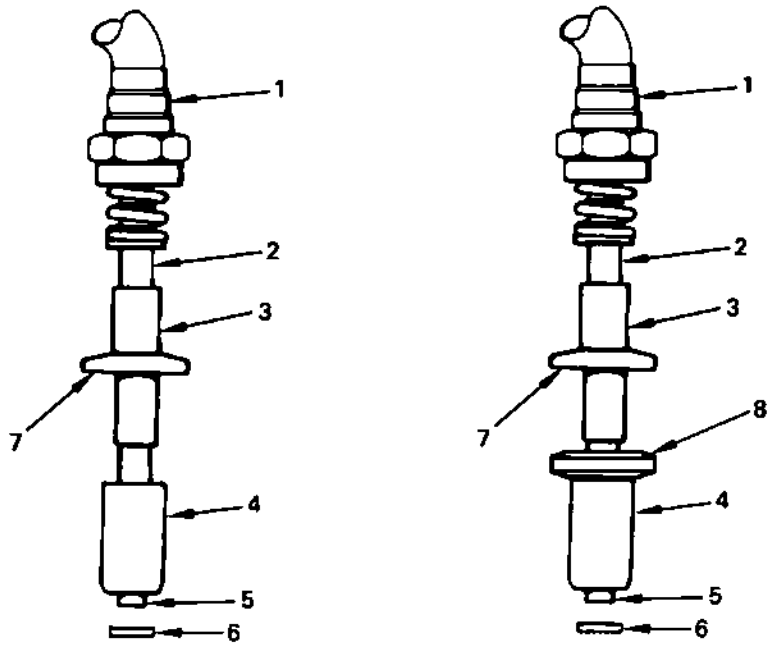
Ignition Exciter
Removal/Installation
Figure 401 (Sheet 2)
(Task 74-11-01-450-001)

IGNITION EXCITER (SINGLE PACK) - REMOVAL/INSTALLATION-00



1. Conduit Assembly (Elbow)
2. Spring Assembly
3. Cable Wire
4. Rubber Bushing (Chamfer Washer)
5. High Tension Insulator
6. Sealing Face

Ignition Exciter Cable
Bushing (Chamfer Washer)
Replacement (Bendix/Unison)
Figure 402
(Task 74-11-01-450-001)



L-H4671 (0101)

1. Conduit Assembly
2. Cable Wire
3. Rubber Bushing
4. High Tension Insulator
5. High Tension Contact
6. Retaining Ring
7. Seal Face
8. Rubber Sealing Washer (Post SB 6246)

Ignition Exciter Cable Bushing
Replacement (Simmonds)
Figure 403
(Task 74-11-01-450-001)

IGNITION EXCITER (SINGLE PACK) - ADJUSTMENT/TEST-00

Task 74-11-01-750-001:

1. 20-4 Joule Exciter (Single Pack) - General

   A. Maintenance testing of the ignition exciter is not available. Send non-functioning ignition exciters to overhaul facility for a complete overhaul check.

IGNITION EXCITER (SINGLE PACK) - INSPECTION/CHECK-00

Task 74-11-01-210-001:

1. 20-4 Joule Ignition Exciter (Single Pack) - Inspection

A. Procedure

(1) Inspect the input connector for bent or damaged pins. Bent pins can be straightened with needlenose pliers. Damaged pins will require overhaul.

(2) Inspect the output receptacle well for damage or signs of arcing or flashover on the contact button. Arcing is identified by pitting or discoloration on contact. Flashover is identified by carbon tracking. If any of these indications are evident, send the exciter to an overhaul facility.

(3) Inspect the threads of each outlet. Minor repair to threads can be made by chasing the threads with correct die. If threads are damaged beyond minor repair, the ignition exciter will require overhaul.

(4) Inspect the case for cracks, dents or large abrasions.

IGNITION EXCITER (SINGLE PACK) - CLEANING/PAINTING-00

Task 74-11-01-110-001:

1. 20-4 Joule Ignition Exciter (Single Pack) - Cleaning

A. Procedure

NOTE: Compressed air must be maintained at 30 psig maximum discharge pressure.

NOTE: Dirt on contact surface will cause reduced output or arcing.

(1) Remove dirt or foreign matter from the inside of the contact well with compressed air.

(2) Clean the ignition exciter outlet contact well with a long bristle, non-metallic brush moistened with cleaning solvent. Dry with compressed air. See Chapter/Section 70-00-00, Standard Practices, SPOP 208.

(3) Clean inner ceramic walls with a circular felt bob, 1/2 inch in diameter and approximately 1 3/4 inches long, suitable for use with hand chuck. Moisten with cleaning solvent. Clean with a circular movement of your hand. Dry with compressed air.

(4) Clean the end surface of the ceramic at the seat of the grommet face with a short bristle non-metallic brush moistened with cleaning solvent. Dry with compressed air.

Task 74-11-01-460-001:

1. Approved Repair of Gap Assembly (Bendix Continuous Duty Exciter 20-4 Joule)

See Figures 801, 802, and 803.

A. Replace the spark gap at the end of each 3000 hours of continuous duty ignition system operation, or at the nearest convenient inspection period.

B. To replace the gap, follow the procedures of step (1) for 10-353875-1 exciters or paragraph (2) for 10-353875-2 exciters.

(1) 10-353875-1 Ignition Exciters.

WARNING: THE IGNITION SYSTEM VOLTAGE IS DANGEROUSLY HIGH. THE IGNITION SWITCH MUST BE IN THE "OFF" POSITION BEFORE YOU REMOVE ANY IGNITION COMPONENTS. ALLOW SEVERAL MINUTES TO ELAPSE BETWEEN OPERATION OF THE IGNITION SYSTEM AND REMOVAL OF IGNITION COMPONENTS. IMMEDIATELY AFTER YOU DETACH THE IGNITER CABLE FROM THE IGNITER PLUG, DISCHARGE THE CURRENT BY GROUNDING THE IGNITER CABLE TERMINAL TO MAKE SURE THE ENERGY FROM THE IGNITION SYSTEM IS COMPLETELY DISSIPATED. FAILURE TO FOLLOW THIS PROCEDURE COULD RESULT IN SEVERE INJURY TO PERSONNEL.

(a) Cut the lockwire and remove the nut, gasket and the 10-371535 spark gap assembly from the housing.

(b) Install a new 10-371535 spark gap assembly or remove the 10-187984 contacts and the 10-371532 insulator from the old spark gap assembly.

(c) Assemble 10-187984 contacts to each end of the new 10-374105-5 spark gap and torque the contacts to 4-6 pound-inches. Install the insulator over the gap as shown in Figure 801.

(d) Put the evacuation tip end of the spark gap assembly into the open end of the 10-371536 nut. Press the parts together to engage the contact of the gap with the nut. See Figure 802.

(e) Put the 10-207142 gasket over the threaded end of 10-371536 nut. See Figure 802.

(f) Screw the assembled parts into the gap well.

(g) Torque the nut to 96 - 120 pound-inches.

(h) Lockwire the nut to the filter nut.

(2) 10-35375-2 Ignition Exciters.

WARNING: THE IGNITION SYSTEM VOLTAGE IS DANGEROUSLY HIGH. THE IGNITION SWITCH MUST BE IN THE "OFF" POSITION BEFORE YOU REMOVE ANY IGNITION COMPONENTS. ALLOW SEVERAL MINUTES TO ELAPSE BETWEEN OPERATION OF THE IGNITION SYSTEM AND REMOVAL OF IGNITION COMPONENTS. IMMEDIATELY AFTER YOU DETACH THE IGNITER CABLE FROM THE IGNITER PLUG, DISCHARGE THE CURRENT BY GROUNDING THE IGNITER CABLE TERMINAL TO MAKE SURE THE ENERGY FROM THE IGNITION SYSTEM IS COMPLETELY DISSIPATED. FAILURE TO FOLLOW THIS PROCEDURE COULD RESULT IN SEVERE INJURY TO PERSONNEL.

(a) Cut the lock wire and remove the threaded cap with the packing, 10-387969 shim ring (if one is installed), cover, and the 10-371535 spark gap assembly from the housing.

(b) Install a new 10-371535 spark gap assembly or remove the 10-187984 contacts and the 10-371532 insulator from the old spark gap assembly.

(c) Assemble the 10-187984 contacts to each end of the 10-374105-5 spark gap. Torque the contacts to 4-6 pound-inches. Install the 10-371532 insulator over the spark gap. See Figure 801.

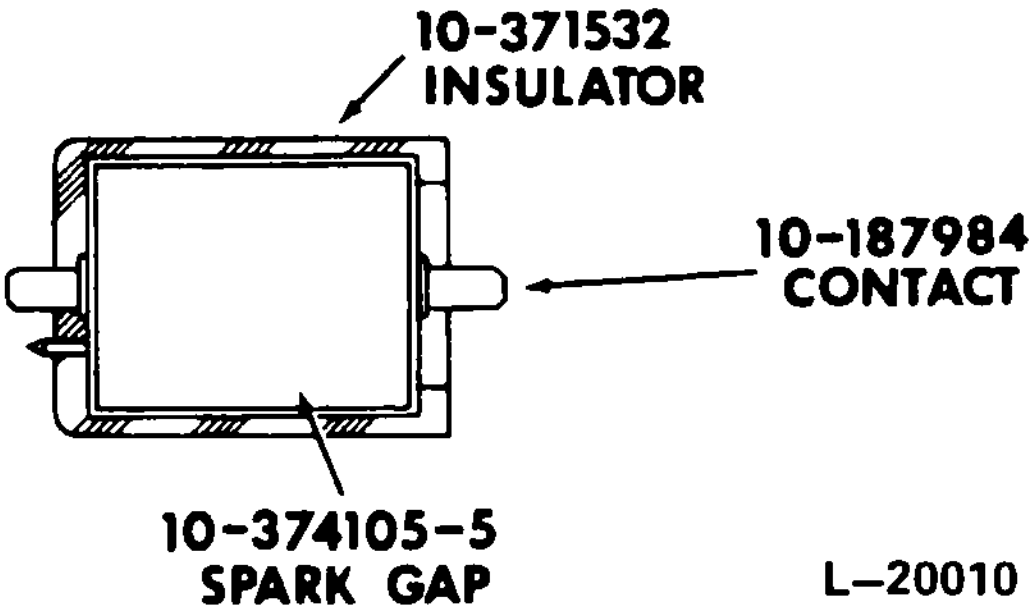
(d) Put the 10-371534 cover over the evacuation tip end of the spark gap assembly. Press the parts together to engage the contact of the gap with the cover. See Figure 803.

(e) Put the assembled cover and gap assembly into the well of the exciter. Align the slot on the side of the cover with a locating pin in the gap well and seat the assembly. Install 10-387969 shim ring if you removed one in step (a).

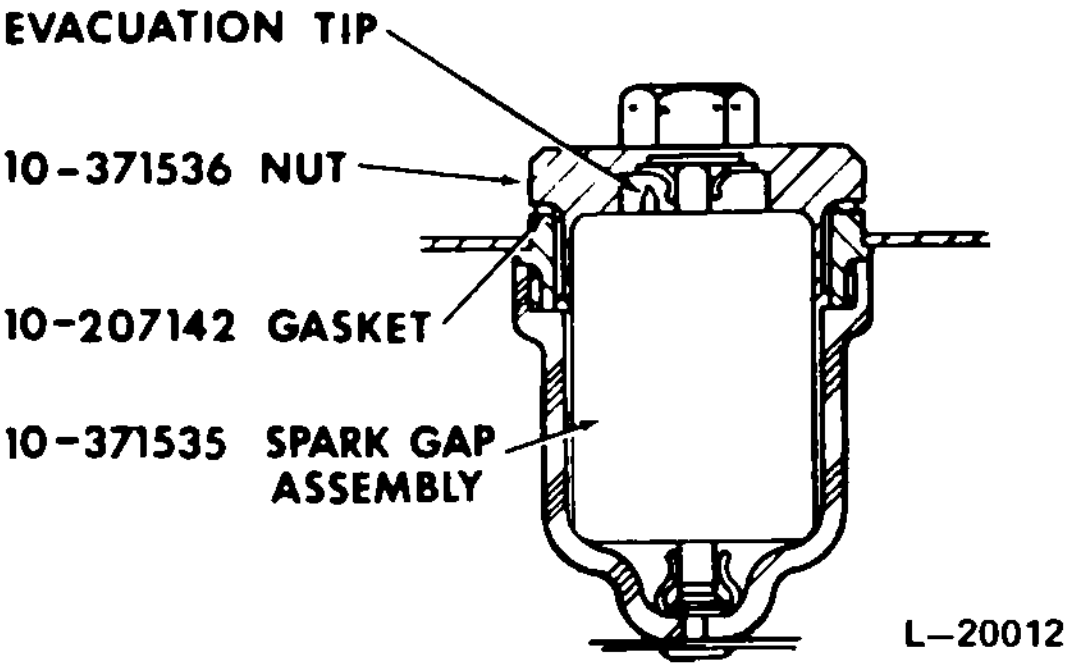
(f) Screw the threaded cap, previously removed from exciter, into the gap well. See Figure 803.

(g) Torque the cap to 90 - 100 pound-inches.

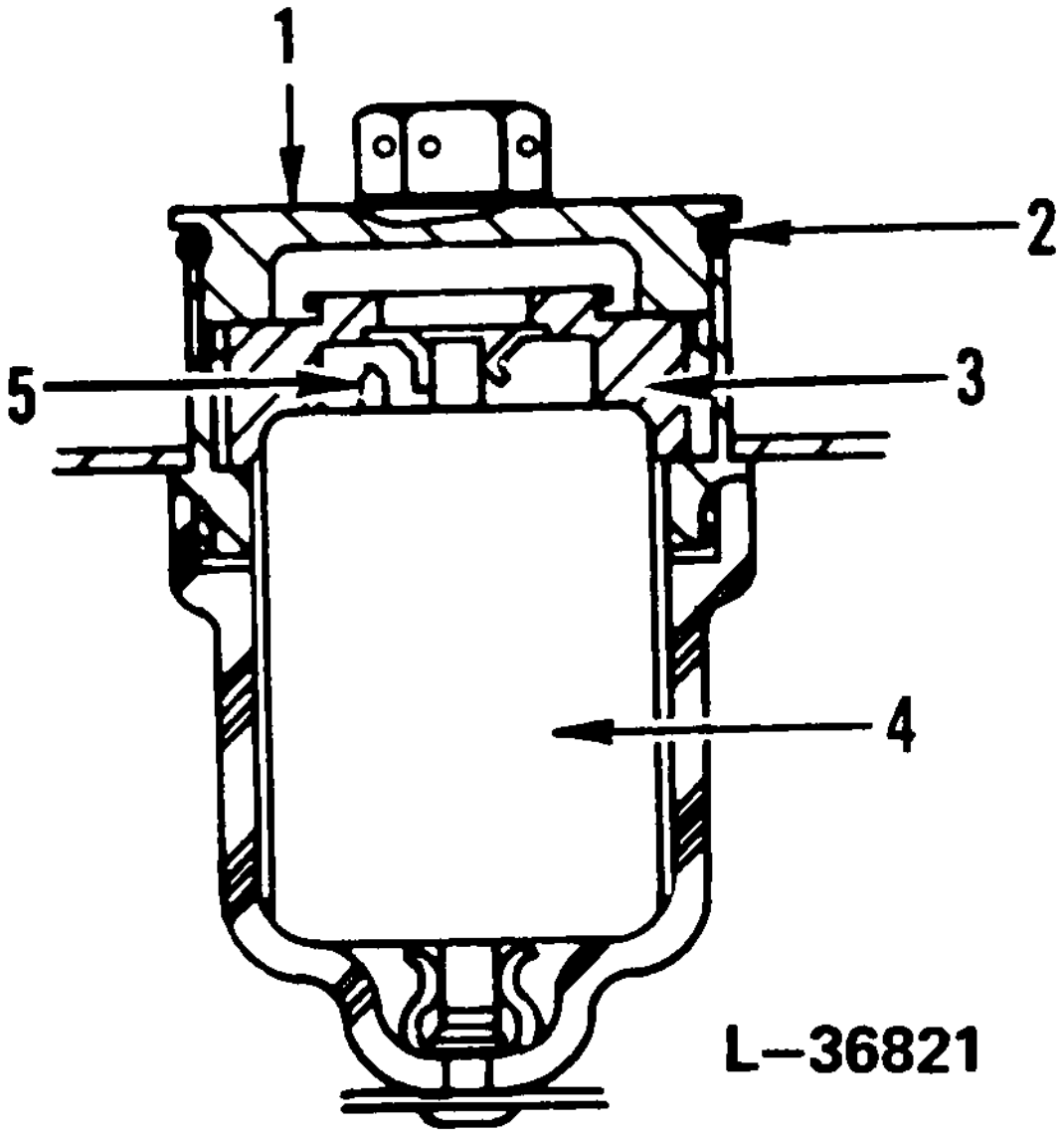
(h) Lockwire the cap to the filter nut.



Ignition Exciter Spark
Gap Assembly 10-371535
Figure 801
(Task 74-11-01-460-001)



Ignition Exciter Spark
Gap Assembly Installation
(10-353875-1 Ignition Exciters)
Figure 802
(Task 74-11-01-460-001)



1. Cap 10-378142
2. O-Ring 10-378141
3. Cover 10-371534
4. Spark Gap Assembly 10-371535
5. Evacuation Tip

Ignition Exciter Spark
Gap Assembly Installation
(10-353875-2 Ignition Exciters)
Figure 803
(Task 74-11-01-460-001)

IGNITION EXCITER (TWIN-PACK) - DESCRIPTION-00

Task 74-11-02-990-001:

1. 20 Joule Ignition Exciter (Twin Pack) - Description

See Figure 1.

A. The 20 Joule Twin-Pack (optional) ignition exciter system consists of two independent 20 Joule, AC-powered intermittent duty capacitor discharger circuits. Each circuit is contained in a completely separate exciter housing with individual power input and high tension output connections. These outputs are electrically connected through the shielded high tension cables to individual igniter plugs. Each 20 Joule circuit can thus be replaced without removing the components of the other circuit.

Task 74-11-02-990-002:

2. 20 Joule Ignition Exciter (Twin Pack) - Operation

See Figure 2.

A. Power is supplied to the input connector of the exciter from the 115 VAC 400 Hz source in the aircraft. Basically each circuit converts the input AC power into high voltage DC for storage as a charge on the tank capacitor. This stored energy is delivered to the igniter plug at the specified spark rate by means of a suitable high tension cable. Provisions in the exciter circuitry enable a high voltage pulse to be delivered to the igniter to provide positive breakdown of the igniter gap under all conditions.

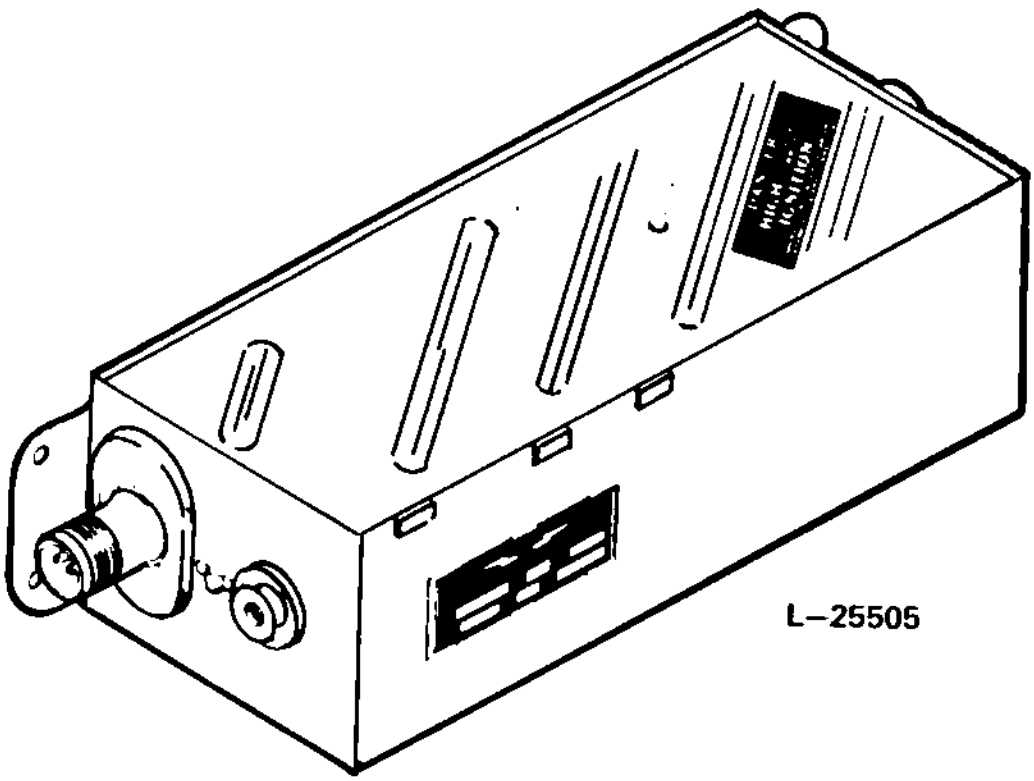
B. The exciter design is reparable using test equipment available in most airline overhaul shops. Positive hermetic seal is assured through use of a stainless steel case weldment. The exciter capability for continuous operation will assure conformance with potential airline ignition duty cycles. Maximum exciter service life can, however, be attained by ignition utilization per recommended engine/or aircraft operational procedures.

NOTE: SB 5803 makes a continuous duty dual unit available. This dual unit has no duty cycle limits, but refer to SB 5803 for periodic inspections on other ignition components.

IGNITION EXCITER (TWIN-PACK) - DESCRIPTION-00

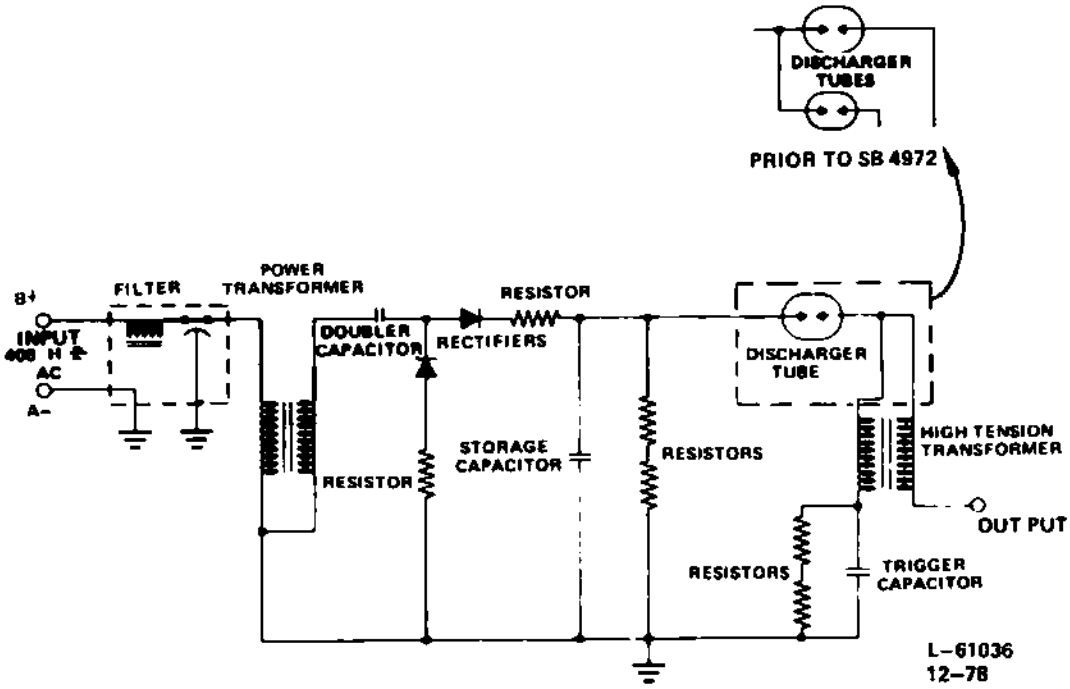
Table of Leading Particulars

Input Connector Pins	"B" Positive "A" Ground
Input Voltage	115 Volts, 400 Hz AC Normal
Spark Rate	0.5 per second
Number of Plugs Fired	One
Stored Energy	20 Joules
Duty Cycle	10 Minutes on, 20 Minutes off
Operating Altitude	Sea Level to 70,000 ft.



Ignition Exciter
(Twin-Pack, 20 Joule)
Figure 1
(Task 74-11-02-990-002)

IGNITION EXCITER (TWIN-PACK) - DESCRIPTION-00



Ignition System Schematic
Figure 2
(Task 74-11-02-990-002)

IGNITION EXCITER (TWIN-PACK) - REMOVAL/INSTALLATION-00

Task 74-11-02-450-001:

1. Removal/Installation of Ignition Exciter - Simmonds - 20 Joule

See Figures 401 thru 403.

A. Removal

WARNING: THE IGNITION SYSTEM VOLTAGE IS DANGEROUSLY HIGH. THE IGNITION SWITCH MUST BE IN THE "OFF" POSITION BEFORE YOU REMOVE ANY IGNITION COMPONENTS. ALLOW SEVERAL MINUTES TO ELAPSE BETWEEN OPERATION OF THE IGNITION SYSTEM AND THE REMOVAL OF IGNITION COMPONENTS. IMMEDIATELY AFTER YOU DETACH THE IGNITER CABLE FROM THE IGNITER PLUG, DISCHARGE THE CURRENT BY GROUNDING THE IGNITER CABLE TERMINAL TO MAKE SURE THE ENERGY FROM IGNITION SYSTEM IS COMPLETELY DISSIPATED. FAILURE TO FOLLOW THIS PROCEDURE COULD RESULT IN SEVERE INJURY TO PERSONNEL.

(1) Disconnect the ignition cables from the left and right igniter plugs and touch each cable electrode to a good engine ground.

(2) Disconnect the coupling nuts that attach the ignition cables to the output connectors on the rear of the exciters.

(3) Install protective caps on the coupling nuts of the cables and on the mating threaded output connectors on the exciters.

(4) Disconnect the coupling nuts which attach two (input) airframe cables to the input connectors on the front of the exciter boxes and install protective covers on nuts and connectors.

(5) Cut the lockwire and remove the four bolts and washers which attach the ignition exciters to the front and rear supports.

(6) Spread the front and rear supports and remove the ignition exciters, input (front) end first.

(7) Remove bolts and locknuts which attach the exciters together.

B. Installation

IGNITION EXCITER (TWIN-PACK) - REMOVAL/INSTALLATION-00

(1) Put the exciters on the bench with the larger threaded (output) connectors at the operator's right. Align the four small holes in the tabs at the ends of both boxes and attach together with bolts and locknuts, boltheads against the upper exciter (away from the operator). Tighten the bolts to the recommended torque.

(2) Spread the front and rear ignition exciter supports and install the ignition exciters between the supports output (rear) end first.

CAUTION: DO NOT USE OF BOLTS LONGER THAN THOSE SPECIFIED FOR MOUNTING THE IGNITION EXCITER. THIS WILL RESULT IN DAMAGE TO THE IGNITION EXCITER HOUSING, WITH SUBSEQUENT LOSS OF HERMETIC SEALING AND RISK OF ELECTRICAL GROUNDING.

(3) Attach the ignition exciters to the supports with four bolts and washers. Torque the bolts and lockwire.

WARNING: IGNITION CABLE RUBBER BUSHINGS AND ADJACENT PARTS MAY CONTAIN RESIDUE OF KRYTOX 240 AC GREASE. DO NOT CONTAMINATE SMOKING MATERIALS (CIGARETTES, CIGARS, ETC.) WITH KRYTOX 240 AC GREASE. COMBUSTION PRODUCTS OF KRYTOX 240 AC GREASE COULD BE HARMFUL IF INHALED. AVOID SKIN CONTACT. WASH HANDS IMMEDIATELY AFTER CONTACT WITH KRYTOX 240 AC GREASE. THIS GREASE IS NO LONGER USED ON JT8D IGNITION CABLES.

(4) Remove caps from coupling nuts on ignition cables.

CAUTION: MAKE SURE THAT THE OUTPUT (HIGH TENSION) LEADS ARE CORRECTLY INSTALLED. INSUFFICIENT TORQUE ON THE LEAD NUTS AT THE EXCITER AND IGNITER ENDS CAN CAUSE IGNITION RADIATED NOISE WHICH CAN BE PICKED UP BY AIRCRAFT RADIO EQUIPMENT.

(5) Replacement of high tension lead rubber bushings (Simmonds/ BF Goodrich/Unison Industries cables). See Figure 402.

NOTE: The bushing replacement procedure is not applicable for new cable assemblies. Do an inspection of the cable during bushing replacement. Either Bendix/Unison or Simmonds

cables can be used interchangeably with the Simmonds ignition exciter. See this paragraph or the paragraph that follows as applicable.

(a) Remove and discard the retaining ring (6) from the high tension contact (5).

(b) Slide the high tension insulator (4), rubber bushing (3) and Post SB 6246 rubber, sealing washer from the cable wire (2). Discard the rubber bushing(s).

NOTE: The retaining ring (6), rubber bushing (3) and Post SB 6246 rubber sealing washer are not available from Pratt & Whitney. See Illustrated Parts Catalog, PN 481675 for part numbers and vendor sources for availability.

(c) Slide the rubber bushing (3), the high tension insulator (4) and, if applicable, Post SB 6246 rubber sealing washer on the cable wire (2) and tighten in place with a new retaining ring (6) on the high tension contact (5).

NOTE: Do not put grease on the insulator or on other details of the cable.

(6) Replacement of high tension lead rubber bushings (chamfer washers) (Bendix/Unison cables). See Figure 403.

NOTE: The bushing (chamfer washer) replacement procedure is not applicable for new cable assemblies. Do an inspection of the cable during bushing (chamfer washer) replacement. Either Bendix/Unison or Simmonds cables can be used interchangeably with the Simmonds ignition exciter. See this paragraph or the previous paragraph as applicable.

WARNING: IGNITION CABLE RUBBER BUSHINGS (CHAMFER WASHERS) AND ADJACENT PARTS MAY CONTAIN RESIDUE OF KRYTOX 240 AC GREASE. DO NOT CONTAMINATE SMOKING MATERIALS (CIGARETTES, CIGARS, ETC.) WITH KRYTOX 240 AC GREASE. COMBUSTION PRODUCTS OF KRYTOX 240 AC GREASE COULD BE HARMFUL IF INHALED. AVOID SKIN CONTACT. WASH HANDS

IMMEDIATELY AFTER CONTACT WITH KRYTOX 240 AC GREASE. THIS GREASE IS NO LONGER USED ON JT8D IGNITION CABLES.

(a) Remove and discard the rubber bushing (chamfer washer) at both ends of the cable.

NOTE: Bendix/Unison bushings (chamfer washers) are not available fron Pratt & Whitney. See Illustrated Parts Catalog, PN 481675 for part numbers and vendor sources for availability.

(b) Slide the new bushing (chamfer washer) in place on the high tension insulator (5).

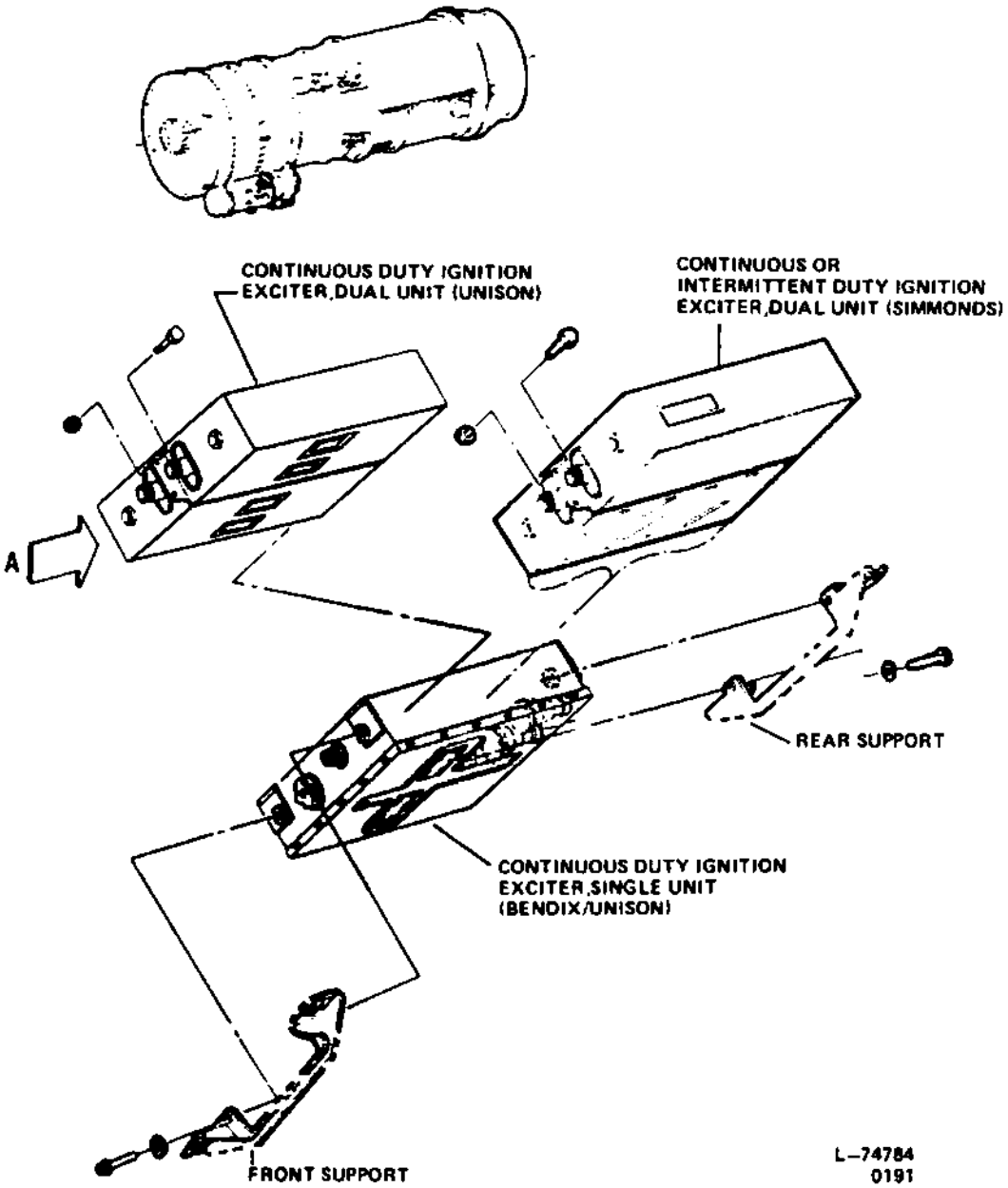
NOTE: Do not put grease on the insulator or on other details of the cable.

(7) Connect the cable coupling nuts to the connectors on the rear of the exciters. Tighten the nuts fingertight, then 45 degrees further maximum (refer to Chapter/Section 72-00-00 Inspection/Check-02 External Parts Fits and Clearances, Reference 113.

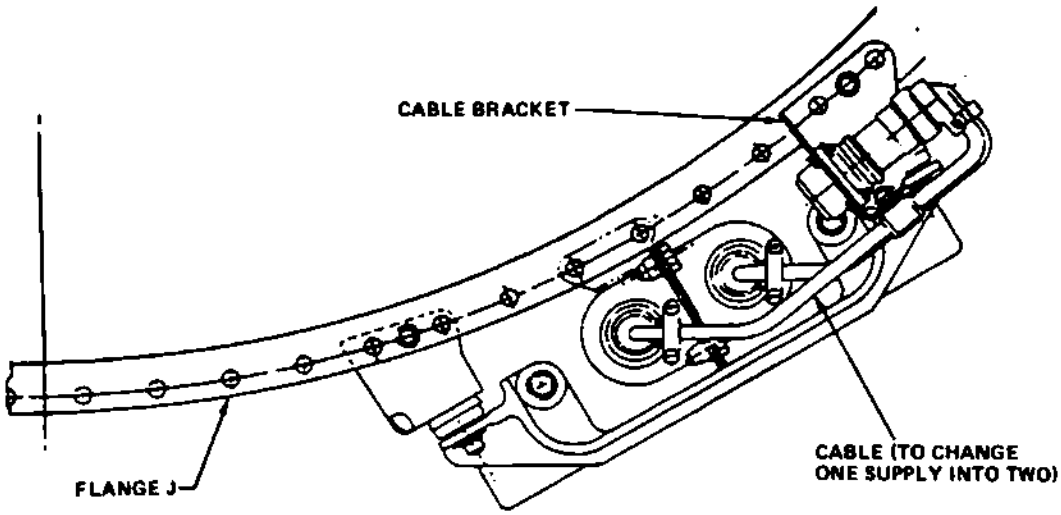
(8) Remove protective caps and attach the exciter coupling nut(s) on the airframe input cable(s) to the threaded connector(s) on the front of the exciter. Tighten to the recommended torque.

(9) Connect the ignition cables to the left and right igniter plugs (refer to Chapter/Section 74-21-01, Removal/ Installation-00).

IGNITION EXCITER (TWIN-PACK) - REMOVAL/INSTALLATION-00



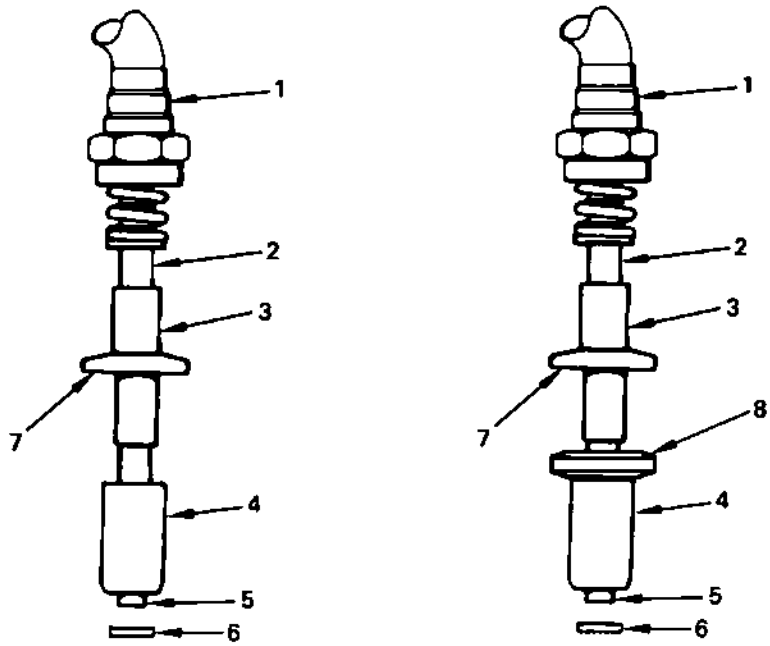
Ignition Exciter
Removal/Installation
Figure 401 (Sheet 1)
(Task 74-11-02-450-001)



VIEW IN DIRECTION A
(UNISON DUAL UNIT ONLY)

L-H0470

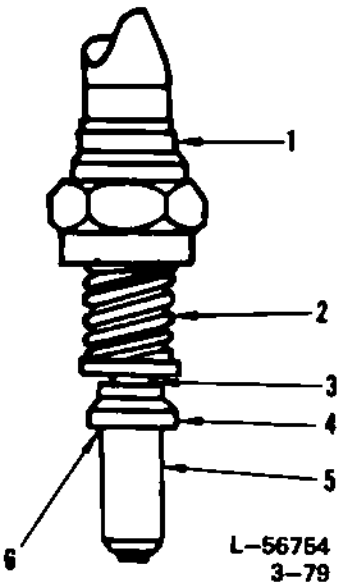
Ignition Exciter
Removal/Installation
Figure 401 (Sheet 2)
(Task 74-11-02-450-001)



L-H4671 (0101)

1. Conduit Assembly
2. Cable Wire
3. Rubber Bushing
4. High Tension Insulator
5. High Tension Contact
6. Retaining Ring
7. Sealing Face
8. Rubber Sealing Washer (Post SB 6246)

Ignition Exciter Cable Bushing
Replacement (Simmonds)
Figure 402
(Task 74-11-02-450-001)



1. Conduit Assembly (Elbow)
2. Spring Assembly
3. Cable Wire
4. Rubber Bushing (Chamfer Washer)
5. High Tension Insulator
6. Sealing Face

Ignition Exciter Cable
Bushing (Chamfer Washer)
Replacement (Bendix/Unison)
Figure 403
(Task 74-11-02-450-001)

Task 74-11-02-210-001:

1. 20 Joule Ignition Exciter (Twin-Pack) - Inspection

   A. Procedure

      (1) Inspect the input connector for bent or damaged pins. Bent pins can be straightened with needlenose pliers. Damaged pins will require overhaul.

      (2) Inspect the output receptacle well for damage or signs of arcing or flashover on the contact button. Arcing is identified by pitting or discoloration on the contact. Flashover is identified by carbon tracking. If any of these indications are evident, send the exciter to an overhaul facility.

      (3) Inspect the threads of each outlet. Minor repair to threads can be made by chasing with a proper die. If threads are damaged beyond minor repair, the ignition exciter will require overhaul.

      (4) Inspect the case for cracks, dents or large abrasions.

IGNITION EXCITER (TWIN-PACK) - CLEANING/PAINTING-00

Task 74-11-02-110-001:

1. 20 Joule Ignition Exciter (Twin-Pack) - Cleaning

A. Procedure

NOTE: Compressed air must be maintained at 30 psig maximum discharge pressure.

NOTE: Dirt on the contact surface will cause reduced output or arcing.

(1) Remove dirt or foreign matter from the inside contact well with compressed air.

(2) Clean the ignition exciter outlet contact well with long bristle, non-metallic brush moistened with cleaning solvent. Dry with compressed air. See Chapter/Section 70-00, Standard Practices, SPOP 208.

(3) Clean the inner ceramic walls with a circular felt bob, 1/2 inch in diameter and approximately 1 3/4 inches long, suitable for use with a hand chuck. Moisten with cleaning solvent. Clean with a circular movement of your hand. Dry with compressed air.

(4) Clean the end surface of the ceramic at seat of the grommet face with a short bristle non-metallic brush moistened with cleaning solvent. Dry with compressed air.

HIGH TENSION LEADS - DESCRIPTION-00

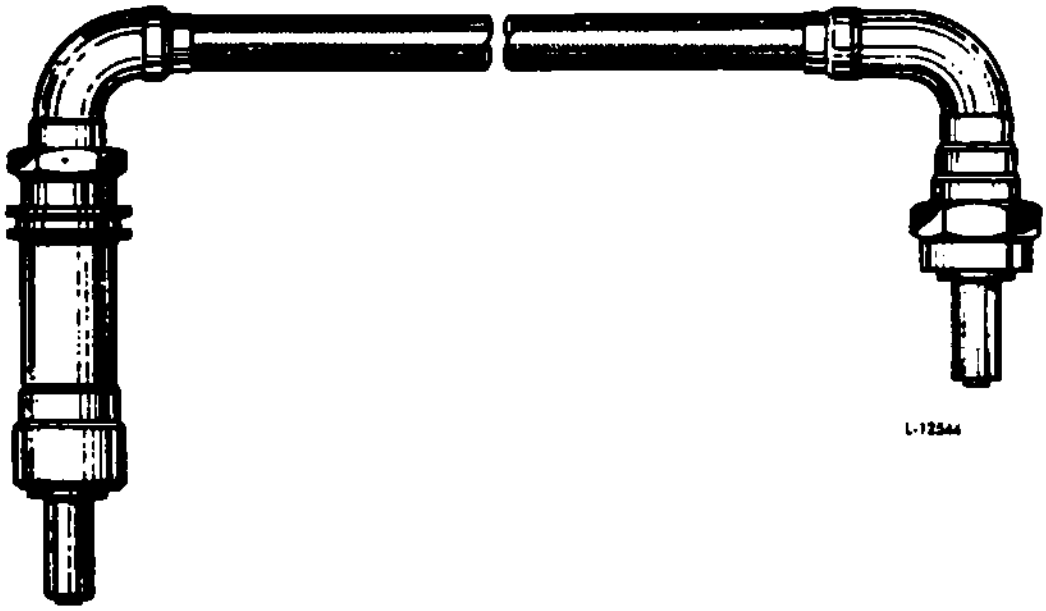
Task 74-21-01-990-001:

1. High Tension Leads

A. Description and Operation
See Figure 1.

(1) The Igniter Plug Lead Assemblies are installed between the ignition exciter and igniter plugs. These lead assemblies carry the electrical energy from the ignition exciter to the igniter plugs. The left lead assembly is approximately 30 inches long and the right lead assembly is approximately 51 inches long.

(2) Rubber bushings (or chamfer washers) at both the exciter and igniter plug ends of the lead assemblies must be replaced at the maintenance level during every lead installation.



Igniter Plug Lead Assembly
Figure 1
(Task 74-21-01-990-001)

Task 74-21-01-450-001:

1. Removal/Installation of the High Tension Leads

See Figures 401 and 402.

A. Removal

WARNING: THE IGNITION SYSTEM VOLTAGE IS DANGEROUSLY HIGH. THE IGNITION SWITCH MUST BE IN THE "OFF" POSITION BEFORE YOU REMOVE ANY IGNITION COMPONENTS. ALLOW SEVERAL MINUTES TO ELAPSE BETWEEN OPERATION OF THE IGNITION SYSTEM AND THE REMOVAL OF IGNITION COMPONENTS. IMMEDIATELY AFTER YOU DETACH THE IGNITER CABLE FROM THE IGNITER PLUG, DISCHARGE THE CURRENT BY GROUNDING THE IGNITER CABLE TERMINAL TO MAKE SURE THE ENERGY FROM THE IGNITION SYSTEM IS COMPLETELY DISSIPATED. FAILURE TO FOLLOW THIS PROCEDURE COULD RESULT IN SEVERE INJURY TO PERSONNEL.

(1) Disconnect the ignition cables from the left and right igniter plugs and touch each cable electrode to a good ground.

(2) Disconnect the coupling nuts that attach the high tension leads to the output connectors on the rear of the ignition exciter.

WARNING: IGNITION CABLE RUBBER BUSHINGS AND ADJACENT PARTS MAY CONTAIN RESIDUE OF KRYTOX 240 AC GREASE. DO NOT CONTAMINATE SMOKING MATERIALS (CIGARETTES, CIGARS, ETC.) WITH KRYTOX 240 AC GREASE. COMBUSTION PRODUCTS OF KRYTOX 240 AC GREASE COULD BE HARMFUL IF INHALED. AVOID SKIN CONTACT. WASH HANDS IMMEDIATELY AFTER CONTACT WITH KRYTOX 240 AC GREASE. THIS GREASE IS NO LONGER USED ON JT8D IGNITION CABLES.

(3) Disconnect the coupling nuts that attach the high tension leads to the left and right igniter plugs.

(4) Install protective caps on the coupling nuts on both ends of the high tension leads, on the mating threaded output connectors on the ignition exciter, and igniter plug openings in the fan discharge duct caused by the removal of the cables.

(5) Remove the nuts and bolts which attach a single clip on the left lead, and four clips on the right lead, to the brackets on Flange J1 and remove the high tension leads with the coupling nut assemblies.

NOTE: Mark the location of the supporting clips to make correct installation easier.

B. Installation

CAUTION: THE CERAMIC INSULATOR MUST BE DRY. MAKE SURE THAT THE HIGH TENSION LEADS ARE CORRECTLY INSTALLED. INSUFFICIENT TORQUE ON THE LEAD NUTS AT THE IGNITION EXCITER AND IGNITER ENDS CAN CAUSE IGNITION RADIATED NOISE WHICH CAN BE PICKED UP BY AIRCRAFT RADIO EQUIPMENT.

(1) Remove protective caps from the coupling nuts on the left and right high tension leads.

(2) Replacement of Bendix/Unison high tension lead rubber bushings (chamfer washers). See Figure 401.

NOTE: The bushing (chamfer washer) replacement procedure is not applicable for new cable assemblies. Do an inspection of the cable during bushing (chamfer washer) replacement.

WARNING: IGNITION CABLE RUBBER BUSHINGS (CHAMFER WASHER) AND ADJACENT PARTS MAY CONTAIN RESIDUE OF KRYTOX 240 AC GREASE. DO NOT CONTAMINATE SMOKING MATERIALS (CIGARETTES, CIGARS, ETC.) WITH KRYTOX 240 AC GREASE. COMBUSTION PRODUCTS OF KRYTOX 240 AC GREASE COULD BE HARMFUL IF INHALED. AVOID SKIN CONTACT. WASH HANDS IMMEDIATELY AFTER CONTACT WITH KRYTOX 240 AC GREASE. THIS GREASE IS NO LONGER USED ON JT8D IGNITION CABLES.

(a) Remove and discard the rubber bushing (chamfer washer) at both ends of the cable.

NOTE: Bendix/Unison bushings (chamfer washers) are not available from Pratt & Whitney. See Illustrated Parts Catalog, PN 481675 for part numbers and vendor sources for availability.

(b) Slide a new bushing (chamfer washer) in place on the high tension insulator (5).

NOTE: Do not put grease on the insulator or on other details of the cable.

(3) Replacement of Simmonds Precision (GLA)/BF Goodrich/Unison Industries high tension lead rubber bushings. See Figure 402

NOTE: The bushing replacement procedure is not applicable for new cable assemblies. Do an inspection of the cable during bushing replacement.

WARNING: IGNITION CABLE RUBBER BUSHINGS AND ADJACENT PARTS MAY CONTAIN RESIDUE OF KRYTOX 240 AC GREASE. DO NOT CONTAMINATE SMOKING MATERIALS (CIGARETTES, CIGARS, ETC.) WITH KRYTOX 240 AC GREASE. COMBUSTION PRODUCTS OF KRYTOX 240 AC GREASE COULD BE HARMFUL IF INHALED. AVOID SKIN CONTACT. WASH HANDS IMMEDIATELY AFTER CONTACT WITH KRYTOX 240 AC GREASE. THIS GREASE IS NO LONGER USED ON JT8D IGNITION CABLES.

(a) Remove and discard the retaining ring (6) from the high tension contact (5).

(b) Slide the high tension insulator (4), rubber bushing (3) and if applicable, Post SB 6246 rubber sealing washer (8) from the cable wire (2). Discard the rubber bushing.

NOTE: The retaining ring (6), rubber bushing (3) and Post SB 6246 rubber sealing washer (8) are not available from Pratt & Whitney. See Illustrated Parts Catalog PN 481675 for part numbers and source vendors for availability.

(c) Slide the rubber bushing (3), existing high tension insulator (4) and if applicable, Post SB 6246 rubber sealing washer (8) on the wire (2) and tighten in place with a new retaining ring (6) on the high tension contact (5).

NOTE: Do not put grease on the insulator or on other details of the cable.

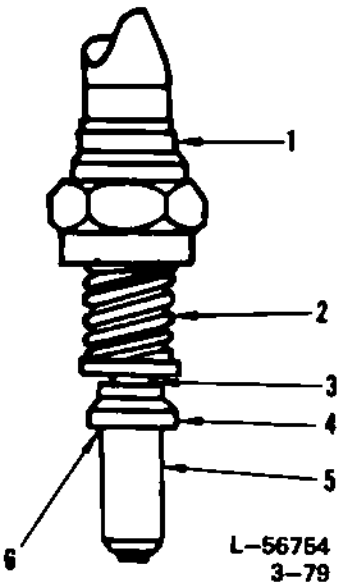
NOTE: Torque all plug-in type threaded connections fingertight plus 45 degree maximum turn.

CAUTION: DO NOT TWIST THE PLUG OF THE CABLE WHEN YOU TURN THE COUPLING NUT. DAMAGE TO THE CABLE COULD RESULT.

(4) Install a new packing in the groove in the OD of the igniter plug coupling nuts on the left and right high tension leads. Clean the threads on the ID of the nuts by SPOP 208 and apply Molykote Type Z. Carefully install the leads into the terminal well of the igniter plugs, thread the coupling nuts on plugs, and tighten to Reference 114, Chapter/Section 72-00-00, "External Parts Fits and Clearances".

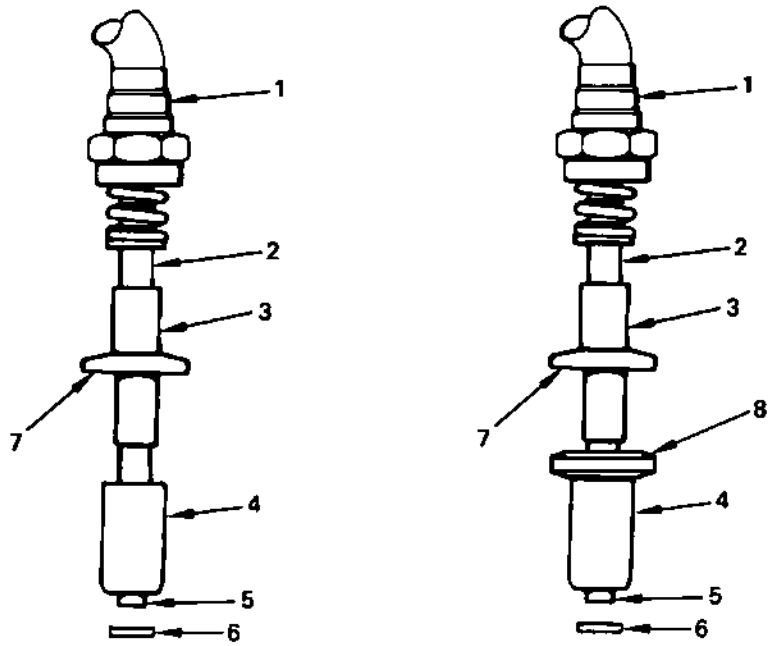
(5) Remove protective caps from the exciter end of the left and right high tension leads. Attach the coupling nuts on the left and right high tension leads to the two threaded connectors on the rear of the exciter. Tighten to Reference 113, Chapter/Section 72-00-00, Inspection/Check-02 "External Parts Fits and Clearances".

(6) Attach a single clip on the left high tension lead, and four clips on the right high tension lead, to the brackets on Flange J1, with bolts and nuts. Tighten to the recommended torque.



1. Conduit Assembly (Elbow)
2. Spring Assembly
3. Cable Wire
4. Rubber Bushing (Chamfer Washer)
5. High Tension Insulator
6. Sealing Face

Bendix/Unison High Tension
Lead Rubber Bushing (Chamfer
Washer) Replacement
Figure 401
(Task 74-21-01-450-001)



L-H4671 (0101)

1. Conduit Assembly
2. Cable Wire
3. Rubber Bushing
4. High Tension Insulator
5. High Tension Contact
6. Retaining Ring
7. Sealing Face
8. Rubber Sealing Washer (Post SB 6246)

Simmonds Precision (GLA)/BF
Goodrich/Unison High Tension
Lead Rubber Bushing Replacement
Figure 402
(Task 74-21-01-450-001)

Task 74-21-01-750-001:

1. Continuity Test and Insulation Test

   A. Procedure

      (1) Check the igniter plug lead assemblies for continuity with an ohmmeter or other low voltage continuity device. There must be continuity from terminal to terminal.

      (2) Use an ohmmeter between the contact and conduit. There must be no indication of insulation breakdown. If insulation breakdown under high voltage is suspected, return the cable to overhaul for further testing.

HIGH TENSION LEADS - INSPECTION/CHECK-00

Task 74-21-01-210-001:

1. Inspection

A. General

(1) Inspect the conduit for cuts, abrasion or other damage, and the coupling nuts for worn or stripped threads.

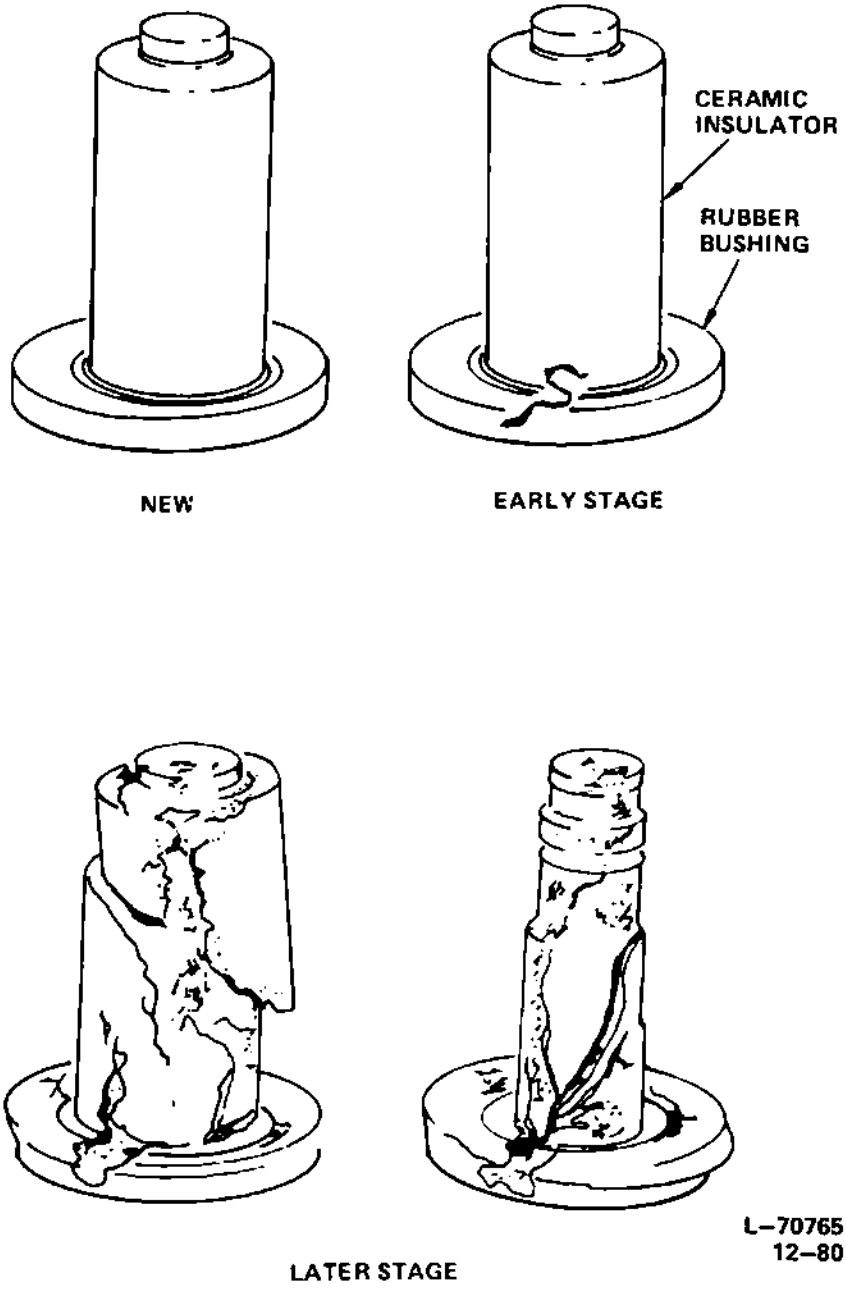
B. High Tension Contact And Cable (See Removal/Installation, Figures 601 and 602)

CAUTION: DO NOT BEND OR PULL THE HIGH TENSION CABLE CONDUCTOR WIRE, OR THE INSULATION WILL BE DAMAGED.

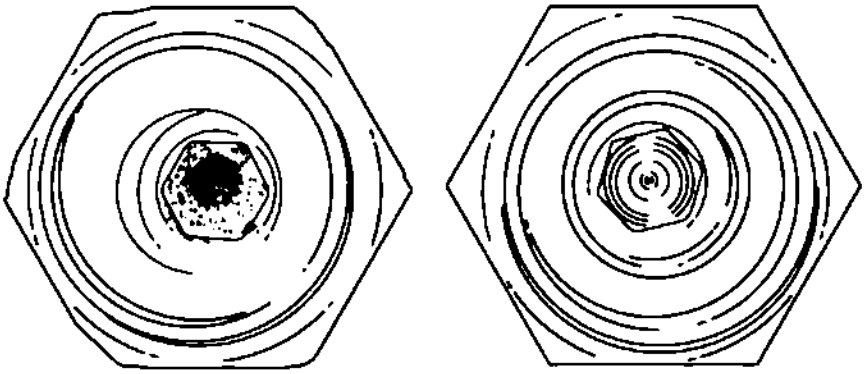
(1) During rubber bushing replacement, inspect for evidence of arcing or flashover on the high tension electrical contact. Inspect exciter-to-igniter plug cables to make sure that excessive temperature has not affected the insulation and grommets. See Figure 601. Arcing is identified by pitting and discoloration. See Figure 602. Flashover is identified by carbon tracking. See Figure 603. If either indication is evident, send the assembly to a repair facility.

(2) If the conductor insulation is hard, brittle, or cracked, send the assembly to a repair facility.

(3) Inspect for presence of oil, dirt, or conductive contaminants on exposed parts. Use cleaning procedures as required.

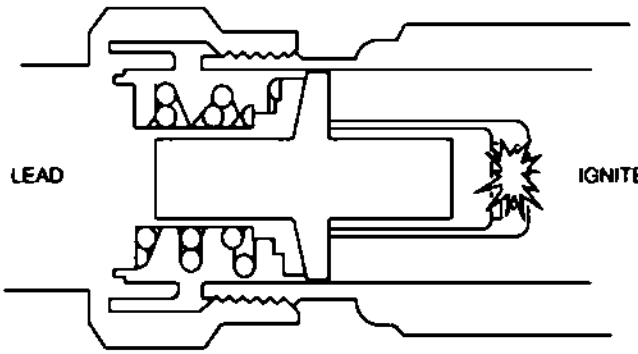


Distressed Ignition Lead Grommets
Figure 601
(Task 74-21-01-210-001)



ARCING ON CONTACT BUTTON

NO ARCING ON CONTACT BUTTON
(NEW IGNITER)



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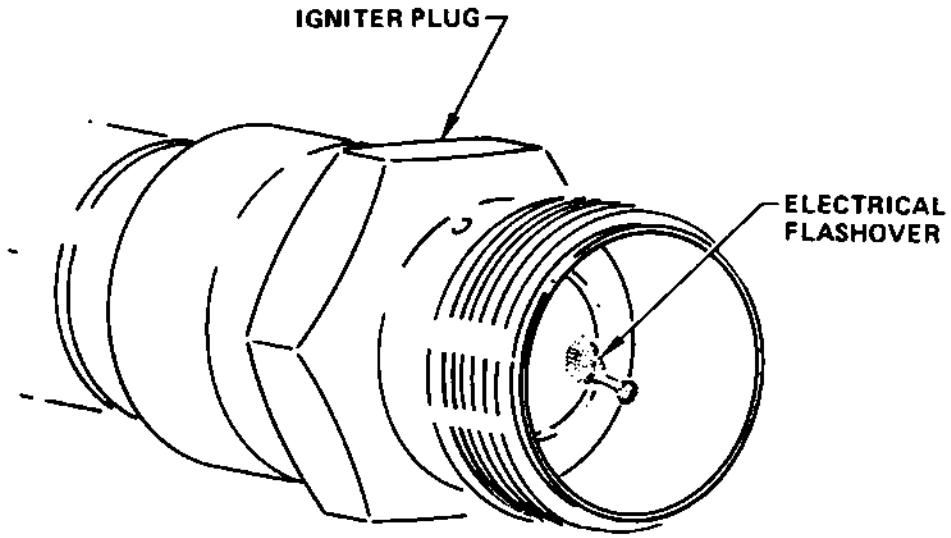
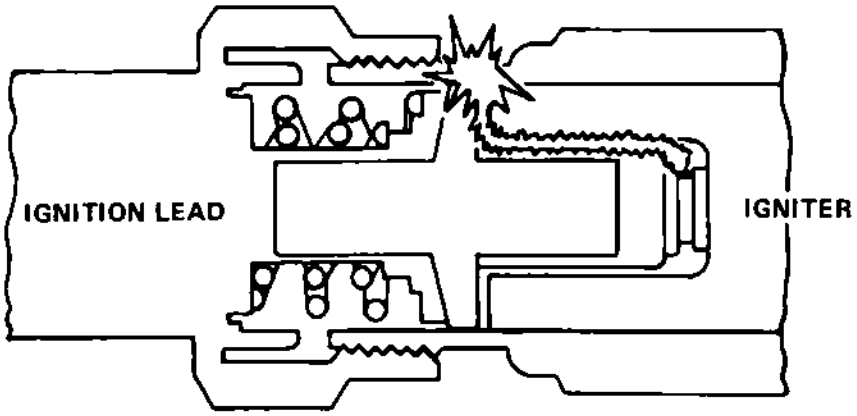
PW V

Electrical Arcing Condition
Figure 602
(Task 74-21-01-210-001)





L-70851
3-80

Electrical Flashover Condition
Figure 603
(Task 74-21-01-210-001)

Task 74-21-01-110-001:

1. Cleaning

A. Procedure

WARNING: IGNITION CABLE RUBBER BUSHINGS AND ADJACENT PARTS MAY CONTAIN RESIDUE OF KRYTOX 240 AC GREASE. DO NOT CONTAMINATE SMOKING MATERIALS (CIGARETTES, CIGARS, ETC.) WITH KRYTOX 240 AC GREASE. COMBUSTION PRODUCTS OF KRYTOX 240 AC GREASE COULD BE HARMFUL IF INHALED. AVOID SKIN CONTACT. WASH HANDS IMMEDIATELY AFTER CONTACT WITH KRYTOX 240 AC GREASE.

NOTE: Compressed air must be maintained at 30 psig maximum discharge pressure.

(1) Remove dirt or foreign matter from the area inside the spring with compressed air.

(2) Wipe the ceramic insulator clean with a clean, lint-free cloth moistened with cleaning solvent. See Chapter/Section 70-00, Standard Practices, SPOP 208. Dry with compressed air.

(3) Wipe the conduit assembly with a clean, lint-free cloth moistened with cleaning solvent. Dry with compressed air.

(4) Clean the high tension contact as necessary with a clean, lint-free cloth moistened with cleaning solvent. Dry with compressed air.

IGNITER PLUGS - DESCRIPTION-00

Task 74-22-01-990-001:

1. Description

See Figure 1.

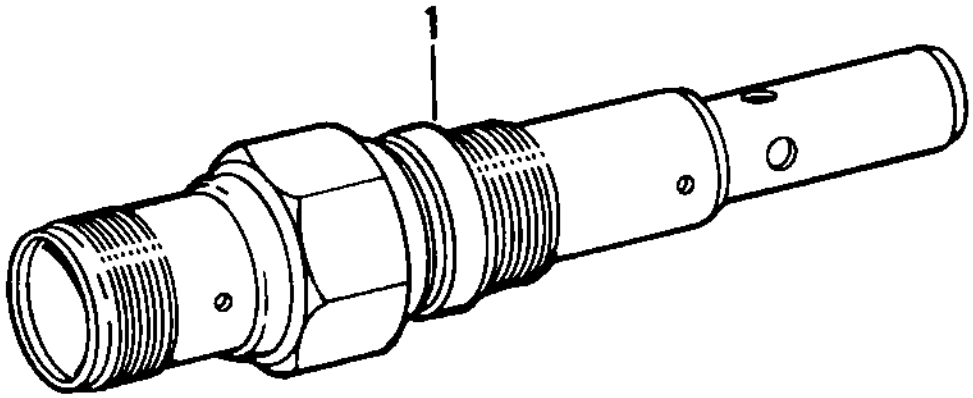
A. There are two igniter plugs which are mounted on the lower front of the combustion chamber outer case. One projects into the number four combustion chamber and the other projects into the number seven combustion chamber.

Task 74-22-01-990-002:

2. Operation

A. An igniter plug provides a gap across which an electrical spark passes to ignite the fuel-air mixture. The igniter plug air gap becomes ionized by very high voltage (22 - 26 KV) provided by a high tension transformer. Once the air gap becomes ionized, current stored in a storage capacitor discharges across the gap. This discharge results in a high temperature plasma arc which is capable of igniting the fuel-air mixture.

NOTE: Pratt & Whitney recommends the use of any igniter plug, regardless of type, that meets the overhaul manual inspection and testing requirements. However, each operator must find out how long the igniter plug can be expected to continue meeting these requirements while exposed to engine use within his operation. This appropriate inspection/cleaning interval can only be established by the individual operator based on his experience.



L-61051

1. Igniter Plug

Igniter Plug
Figure 1
(Task 74-22-01-990-002)

Task 74-22-01-450-001:

1. Removal/Installation of the Igniter Plugs

A. Removal

WARNING: THE IGNITION SYSTEM VOLTAGE IS DANGEROUSLY HIGH. THE IGNITION SWITCH MUST BE IN THE "OFF" POSITION BEFORE YOU REMOVE ANY IGNITION COMPONENTS. ALLOW SEVERAL MINUTES TO ELAPSE BETWEEN OPERATION OF THE IGNITION SYSTEM AND REMOVAL OF THE IGNITION COMPONENTS. IMMEDIATELY AFTER YOU DETACH THE IGNITER CABLE FROM THE IGNITER PLUG, DISCHARGE THE CURRENT BY GROUNDING THE IGNITER CABLE TERMINAL TO MAKE SURE THE ENERGY FROM THE IGNITION SYSTEM IS COMPLETELY DISSIPATED. FAILURE TO FOLLOW THIS PROCEDURE COULD RESULT IN SEVERE INJURY TO PERSONNEL.

(1) Disconnect the coupling nuts which attach the cables to the left and right igniter plugs and touch the cable electrodes to a good ground. Install protective covers on coupling nuts.

WARNING: FOR ADDITIONAL PROTECTION AGAINST ELECTRICAL HAZARD, AFTER YOU DETACH THE IGNITER PLUG COUPLING NUTS, TOUCH THE CONNECTOR CONTACT TO THE IGNITER PLUG BODY SHIELD.

(2) Remove nuts, washers, bolts and spacer sleeves which attach the packing holders to the left and right igniter bosses on the fan duct, and remove the packing holders.

CAUTION: IT WILL BE NECESSARY TO REPLACE THE IGNITER PLUG YOU DROP IT.

(3) Remove the igniter plugs from the combustion chamber outer case. If required for reference, identify the location (left or right) from which you removed the the plugs.

CAUTION: PERMANENTLY ATTACH THE SOCKET TO THE EXTENSION BEFORE YOU USE IT. THIS WILL PREVENT DISENGAGEMENT OF THE SOCKET FROM THE WRENCH EXTENSION DURING THE REMOVAL OF THE IGNITER PLUGS (WHICH COULD RESULT IN LOSS OF THE SOCKET BETWEEN THE FAN DUCT AND OUTER CASE).

(4) Individually wrap the igniter plugs in wax paper and put them in a suitable box.

B. Installation

(1) Check the condition of the igniter plug boss threads. Clean up the threads with PWA 33647 (formerly PWA 8597) Tap if necessary.

(2) Remove the protective covers from the igniter plugs. Clean the threads of the igniter plugs and combustion chamber case bosses by SPOP 208 Solvent. See Chapter/Section 70-00-00, Standard Practices.

CAUTION: DO NOT USE PMC 9940 ANTISEIZE COMPOUND (SILVER GOOP) ON THE IGNITER OR BOSS THREADS IF A DIFFERENT COMPOUND WAS USED BEFORE. IF PMC 9940 (SILVER GOOP) IS USED WHERE OTHER COMPOUNDS HAVE BEEN USED BEFORE, IT CAN BECOME HARD AFTER ENGINE OPERATION.

(3) Apply a small quantity of antigalling or antiseize compound to the threads of the igniter plugs, case bosses and gasket faces. Use one of the compounds that follow:

(a) PMC 9936 Antigalling Compound.

(b) PMC 9940 Antiseize Compound (Silver Goop).

(c) GB Mica Lube A768 Antiseize Compound.

CAUTION: MAKE SURE YOU INSTALL THE SAME TYPE OF IGNITER PLUG THAT YOU REMOVED. USE TWO GASKETS (PN 182888 OR 266315) WITH SHORT TYPE IGNITER PLUGS ONLY (REFERENCE PN 464332). THE IGNITER PLUGS LISTED ABOVE MUST BE USED ONLY ON ENGINES INCORPORATING THE CONFIGURATION OF PARTS THAT FOLLOWS.

- COMBUSTION CHAMBER OUTER CASE PN 490547

- "ONE-PIECE" DESIGN COMBUSTION CHAMBERS OF PN 534XXX SERIES.

(4) Before you install the igniter plugs, look through the igniter plug bosses on the combustion section fan duct at each igniter plug guide to be sure that the guide is centrally located. If required, install a suitable tool through the plug port and align the guide to its approximate proper position.

NOTE: A locally fabricated tool as shown in Figure 401 can be used.

(5) Install a new gasket on each igniter plug. Install the plugs through the holes in the fan duct igniter bosses and into the mating threaded holes in the combustion chamber outer case. Bottom each plug by hand to prevent excessive galling of the igniter plug tip and lower shell before you torque them. This will ensure that the igniter plug and burner can igniter plug guide are properly aligned. See Figure 402 for the necessary radial distance for a correctly installed igniter plug.

CAUTION: PERMANENTLY ATTACH THE SOCKET TO THE EXTENSION BEFORE YOU USE IT. THIS WILL PREVENT DISENGAGEMENT OF THE SOCKET FROM THE WRENCH EXTENSION DURING THE REMOVAL OF THE IGNITER PLUGS (WHICH COULD RESULT IN LOSS OF THE SOCKET BETWEEN THE FAN DUCT AND OUTER CASE) .

(6) Tighten the plugs to the torque indicated in Fits and Clearances Reference 1021, Chapter/Section 72-00, Removal/Installation.

(7) Install a new packing on each holder. Put the holders on the respective right and left fan duct igniter plug bosses. Put a spacer sleeve on each of four bolts. Install these bolts through the holes in the holder and boss. Put washers on bolts and attach with self-locking nuts. Torque the bolts.

CAUTION: MAKE SURE THAT THE OUTPUT (HIGH TENSION) LEADS ARE CORRECTLY INSTALLED IN THE IGNITER PLUGS. INSUFFICIENT TORQUE ON THE LEAD NUTS CAN CAUSE IGNITION RADIATED NOISE WHICH CAN BE PICKED UP BY AIRCRAFT RADIO EQUIPMENT.

(8) Remove protective caps from the coupling nuts on the ignition cables.

(9) Replacement of Bendix high tension lead rubber bushings (chamfer washers). See Figure 403.

NOTE: The bushing (chamfer washer) replacement procedure is not applicable for new cable assemblies. Do an inspection of the cable during bushing (chamfer washer) replacement.

WARNING: IGNITION CABLE RUBBER BUSHINGS (CHAMFER WASHERS) AND ADJACENT PARTS MAY CONTAIN RESIDUE OF KRYTOX 240 AC GREASE. DO NOT CONTAMINATE SMOKING MATERIALS (CIGARETTES, CIGARS ETC.) WITH KRYTOX 240 AC GREASE. COMBUSTION PRODUCTS OF KRYTOX 240 AC GREASE COULD BE HARMFUL IF INHALED. AVOID SKIN CONTACT. WASH HANDS IMMEDIATELY AFTER CONTACT WITH KRYTOX 240 AC GREASE. THIS GREASE IS NO LONGER USED ON JT8D IGNITION CABLES.

(a) Remove and discard the rubber bushing (chamfer washer) at the igniter plug end of the cable.

NOTE: Bendix/Unison bushings (chamfer washers) are not available from Pratt & Whitney. See Illustrated Parts Catalog, PN 481675 for part numbers and vendor sources for availability.

(b) Slide a new bushing (chamfer washer) in place on the high tension insulator (5).

NOTE: Do not put grease on the insulator or on other details of the cable.

(10) Replacement of Simmonds Precision (GLA)/BF Goodrich/Unison high tension lead rubber bushings. See Figure 404.

NOTE: The bushing replacement procedure is not applicable for new cable assemblies. Do an inspection of the cable during bushing replacement.

WARNING: IGNITION CABLE RUBBER BUSHINGS AND ADJACENT PARTS MAY CONTAIN RESIDUE OF KRYTOX 240 AC GREASE. DO NOT CONTAMINATE SMOKING MATERIALS (CIGARETTES, CIGARS ETC.) WITH KRYTOX 240 AC GREASE. COMBUSTION PRODUCTS OF KRYTOX 240 AC GREASE COULD BE HARMFUL IF INHALED. AVOID SKIN CONTACT. WASH HANDS IMMEDIATELY AFTER CONTACT WITH KRYTOX 240 AC GREASE. THIS GREASE IS NO LONGER USED ON JT8D IGNITION CABLES.

(a) Remove and discard the retaining ring (6) from the high tension contact (5).

(b) Slide the high tension insulator (4), rubber bushing (3) and if applicable, Post SB 6246 rubber sealing washer (8) from the cable wire (2). Discard the rubber bushing.

NOTE: The retaining ring (6), rubber bushing (3) and if applicable, Post SB 6246 rubber sealing washer (8) are not available from Pratt & Whitney. See Illustrated Parts Catalog, PN 481675 for part numbers and vendor sources for availability.

(c) Slide the rubber bushing (3), existing high tension insulator (4) and if applicable, Post SB 6246 rubber sealing washer (8) on the cable wire (2) and tighten in place with a new retaining ring (6) on the high tension contact (5).

NOTE: Do not put grease on the insulator or on other details of the cable.

CAUTION: DO NOT TWIST THE PLUG OF THE CABLE WHEN YOU TURN THE COUPLING NUT. DAMAGE TO THE CABLE COULD RESULT.

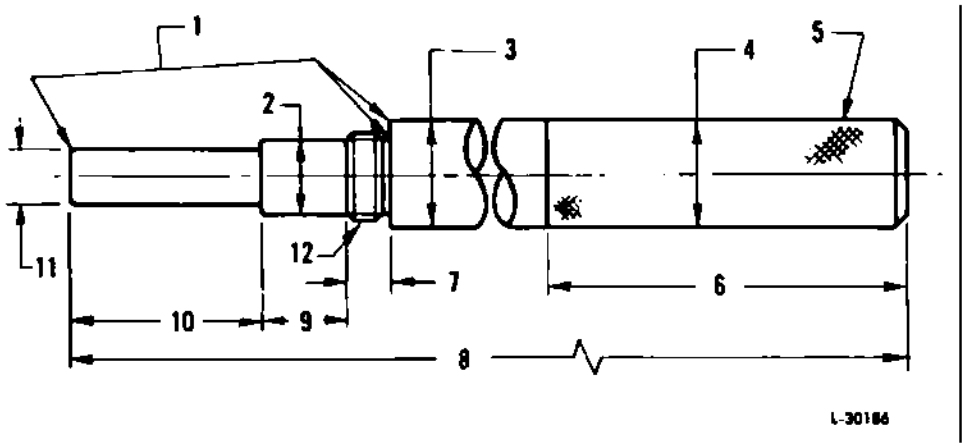
(11) Remove protective caps and install a new packing in the groove on the OD of the igniter plug coupling nuts on the left and right output cable assemblies. Clean the threads on the ID of these nuts by SPOP 208 and apply Molykote Type Z. Carefully install the leads into the terminal well of the igniter plugs, thread the coupling nuts on the plugs, and tighten to the recommended torque (Chapter/Section 72-00-00, Inspection/Check-02, Reference 114).

Task 74-22-01-990-003:

2. Special Tools

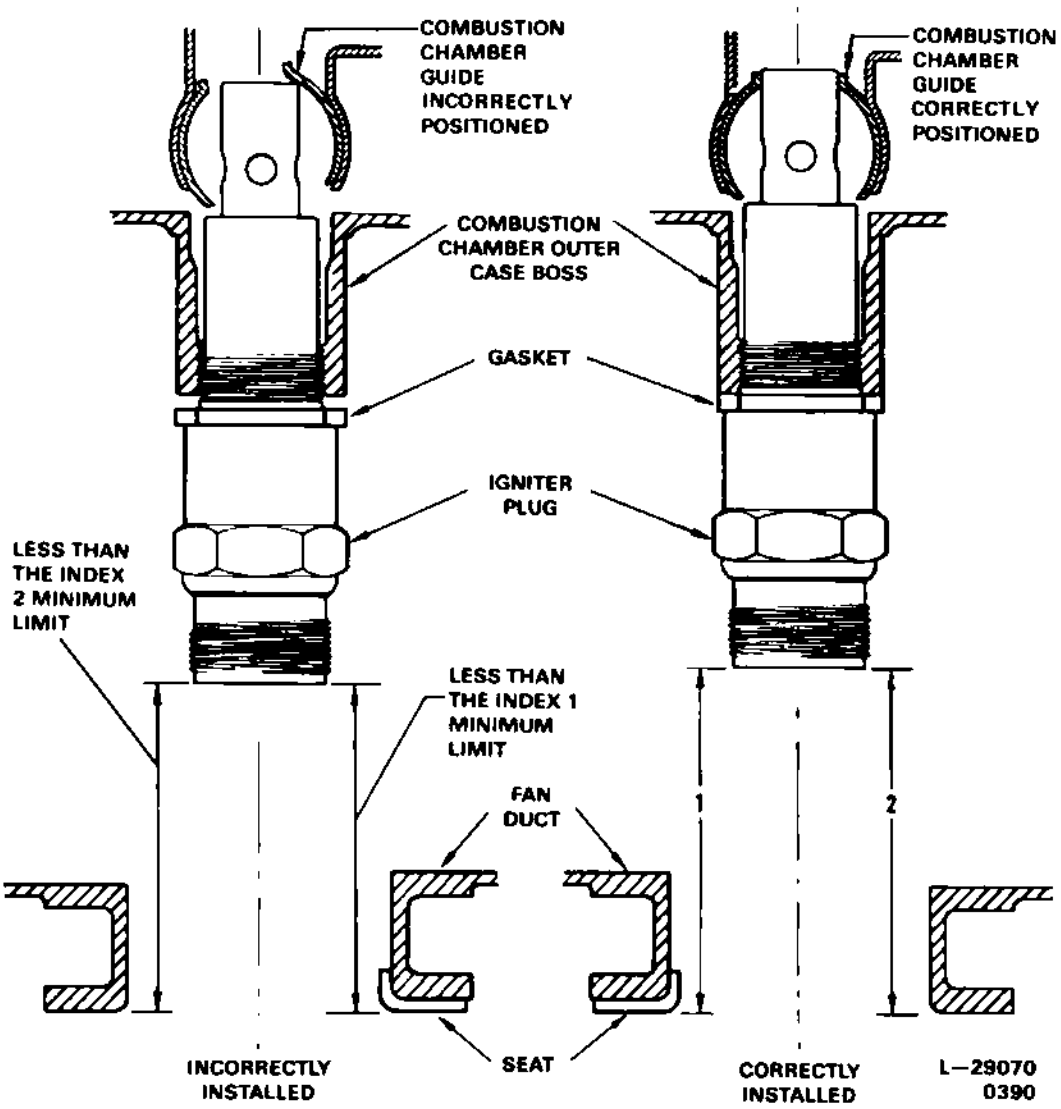
A. Special Tools

PWA 8597 Tap-Igniter Plug Boss
(Superseded by PWA 33647)
PWA 33647 Tap-Igniter Plug Boss
(Supersedes PWA 8597)



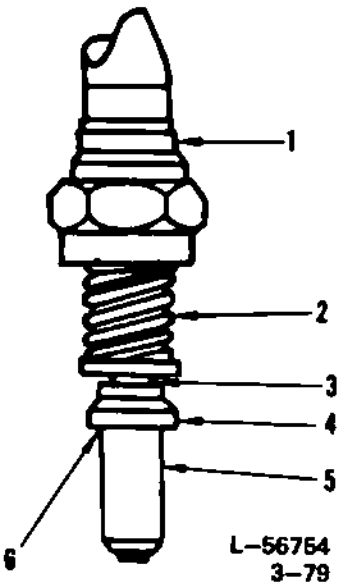
1. 1/32 Inch Radius
2. 0.808 - 0.820 Inch Diameter
3. 1.107 - 1.112 Inch Diameter
4. 1 1/8 Inch Diameter
5. Knurl
6. 3 3/4 - 4 1/4 Inches
7. 3/8 Inch
8. 13 3/8 Inches
9. 1.033 - 1.053 Inches
10. 1 7/8 - 2 Inches
11. 0.556 - 0.562 Inch Diameter
12. 0.9375 - 16NS; Pitch Diameter - 0.8903 - 0.8939 Inch
    Major Diameter - 0.9255 - 0.9345 Inch
    Minor Diameter - 0.8578 Inch Maximum

Combustion Chamber Igniter
Plug Guide Aligning Tool
Figure 401
(Task 74-22-01-990-003)



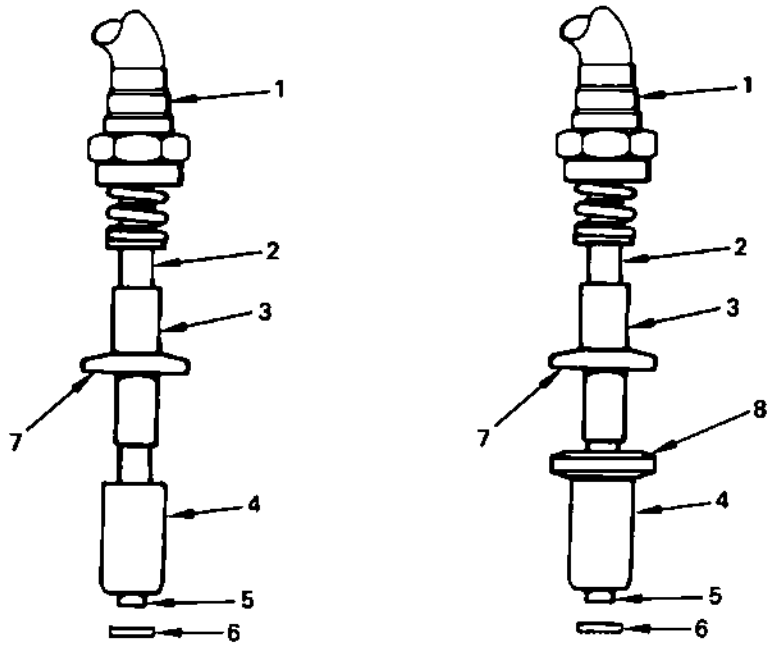
1. 2.080 - 2.210 Inches (52.8 - 56.1 mm) For Correctly Installed Igniter Plug With Seat.
2. 2.025 - 2.145 Inches (51.4 - 54.5 mm) For Correctly Installed Igniter Plug Without Seat.

Installation of Igniter Plugs
Figure 402
(Task 74-22-01-990-003)



1. Conduit Assembly (Elbow)
2. Spring Assembly
3. Cable Wire
4. Rubber Bushing (Chamfer Washer)
5. High Tension Insulator
6. Sealing Face

Ignition Exciter Cable
Bushing (Chamfer Washer)
Replacement (Bendix/Unison)
Figure 403
(Task 74-22-01-990-003)



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1. Conduit Assembly
2. Cable Wire
3. Rubber Bushing
4. High Tension Insulator
5. High Tension Contact
6. Retaining Ring
7. Sealing Face
8. Rubber Sealing Washer (Post SB 6246)

Ignition Exciter Cable
Bushing Replacement
(Simmonds/BF Goodrich/Unison)
Figure 404
(Task 74-22-01-990-003)

Task 74-22-01-750-001:

1. Igniter Plug Testing

A. Igniter Plug Audible Check

CAUTION: BEFORE THE AUDIBLE CHECK, MOTOR THE ENGINE IF YOU THINK THERE IS UNBURNED FUEL IN THE ENGINE. UNBURNED FUEL CAN CAUSE AN INTERNAL ENGINE OR TAILPIPE FIRE.

CAUTION: DO NOT PERMIT ENGINE N2 ROTATION DURING THE IGNITER AUDIBLE CHECK. IF N2 ROTATES, FUEL CAN ENTER THE COMBUSTION CHAMBER WHEN THE START LEVER IS ADVANCED TO THE "ON" POSITION. INADVERTENT LIGHT-UP DURING IGNITER CHECK CAN RESULT.

(1) Do an audible check of each igniter plug to make sure that it is operating. Apply power to one side at a time to check each system individually.

NOTE: Audible check is not 100 percent positive. Snapping can be a spark jumping in an area other than the igniter tip.

(2) After you complete the audible check, move the engine ignition switch to the OFF position.

IGNITER PLUGS - INSPECTION/CHECK-00

Task 74-22-01-210-001:

1. Igniter Plug Inspection

See Figures 601 and 602.

A. Inspection

(1) Visually inspect connector threads and shell threads of the igniter. If damaged, chase the threads with a 1.000-20NS-3A die for connector threads and 0.9375-16NS die for shell threads.

(2) Inspect ceramic for cracks on either end of the plug. Cracks in the ceramic are cause for rejection of the igniter plug. Shake the plug and listen for a rattle to find Internal ceramic breaks or cracks.

(3) Inspect wear of the plug with a lighted magnifying glass. Look through the shell end annulus to determine if the insulator supporting shoulder is worn through. Wear of a Champion plug can be measured with a service wear measuring tool CT-492 (formerly CT-468). See Figure 601.

NOTE: Visual determination of excessive wear is the only practical means of evaluating plug wear. The maximum outer shell ID erosion is a physical limit to prevent possible loss of ceramic support by the ground shell which can result in ceramic cracking and internal firing. When excessively eroded, the ceramic can be ingested by the turbine. You can use center electrode depth to determine plug serviceability limit when preferred by individual operators.

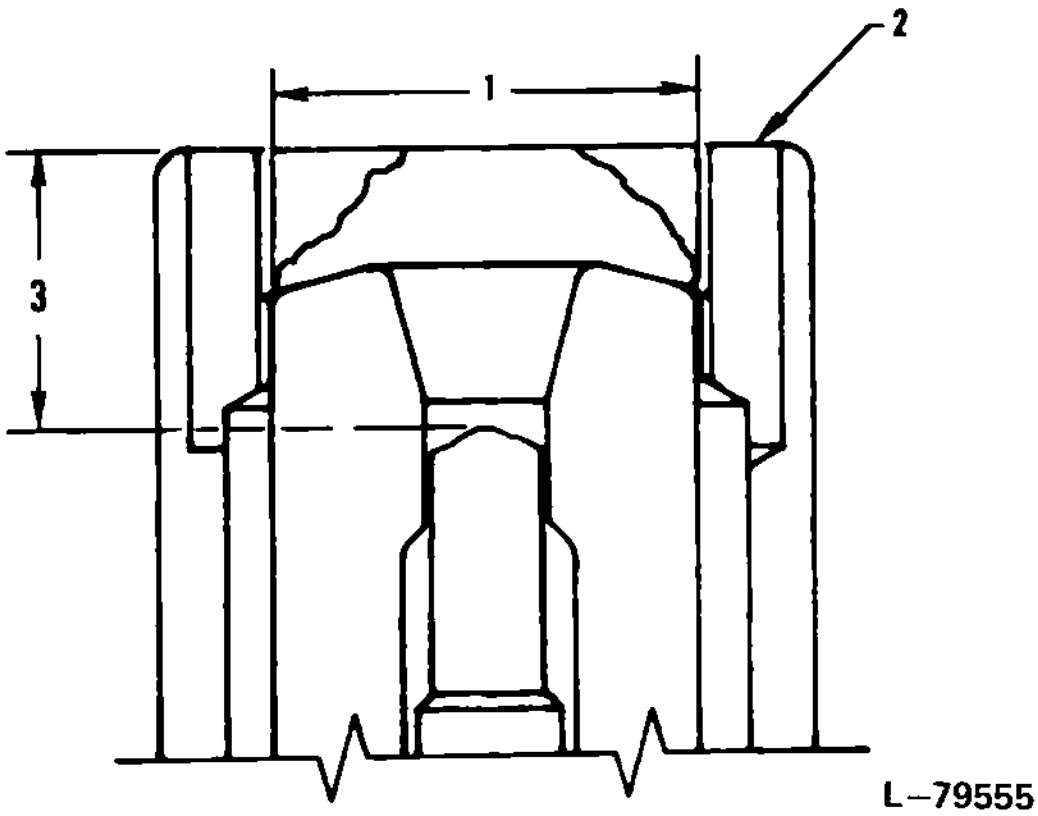
NOTE: Service wear measuring tool CT-492 (formerly CT-468) can be purchased from: Champion Spark Plug Co., 900, Upton, Toledo, Ohio 43601 U.S.A.

NOTE: Although the igniter will continue to fire after exceeding erosion limits, the voltage necessary to discharge across the spark gap increases with increasing erosion and can stress other components, particularly the high tension parts.

(4) Inspect igniter plugs in areas shown in Figures 601 and 602 for abrasion. Reject plugs that do not meet required abrasion wear limits.

(5) Whenever you remove the high tension lead from the igniter plug terminal, inspect the igniter plug terminal well.

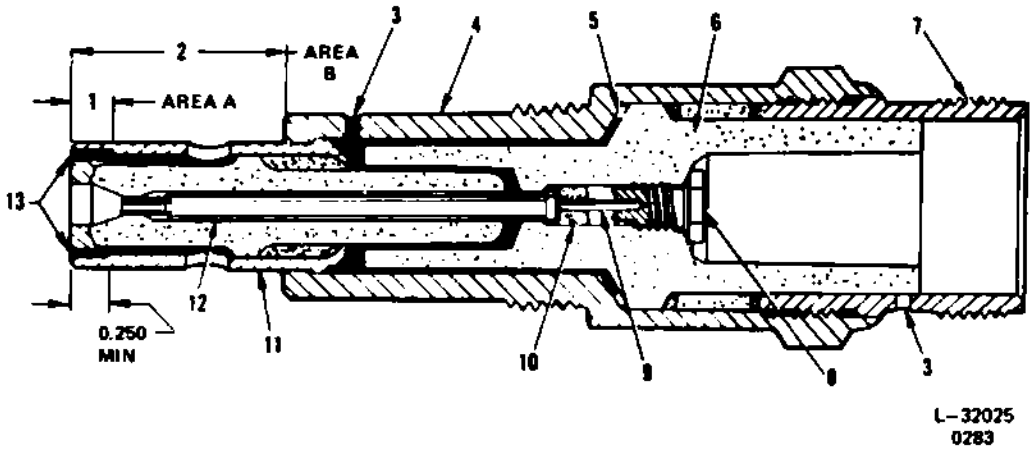
(a) Inspect the igniter plug terminal for evidence of arcing and flashover. Arcing is identified by pitting or discoloration on contact. See Figure 603. Flashover is identified by carbon tracking. See Figure 604. If any of these indications are evident, replace the igniter plug.



1. 0.325 Inch ID Maximum Outer Shell Erosion
2. Air Cooling Holes
3. Center Electrode Depth For New Igniter Plugs Only.
   0.221 ± 0.005 Inch For SLG Auburn Igniter Plug.
   0.240 ± 0.015 Inch For Champion Igniter Plug.

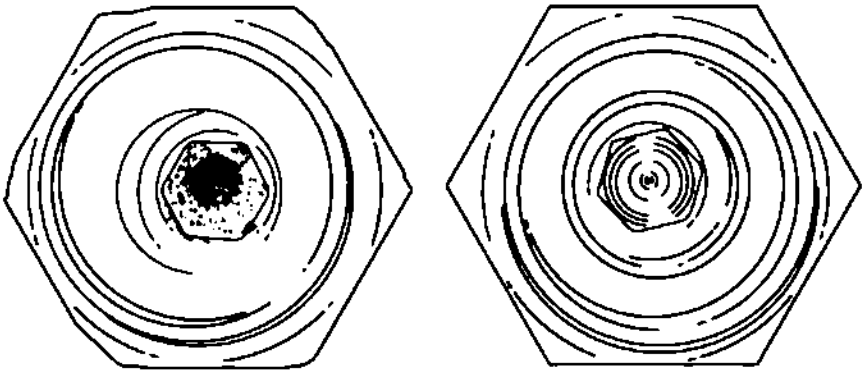
   NOTE: When preferred by operators, depth may be used to determine serviceable limit based on individual operator experience.

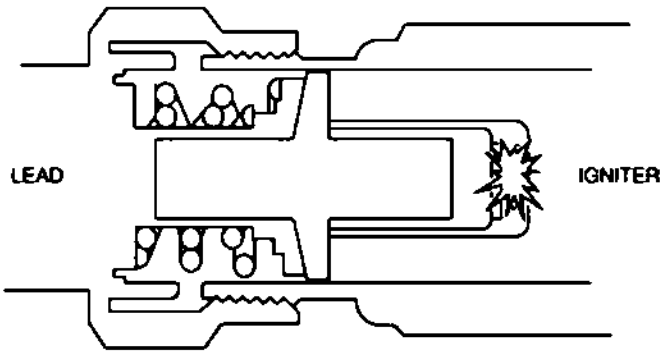
Igniter Plug Erosion Limit
Figure 601
(Task 74-22-01-210-001)



1. Area A, Exposure Of One Air Cooling Passage Or 0.030 Inch Wear Depth.
2. Area B. 0.030 Inch Maximum Wear Depth.
3. Condensation Drain Hole
4. Upper Shell
5. Gasket
6. Insulator
7. Coupling Thread
8. Terminal Screw
9. Sealing Wire
10. Cement
11. Lower Shell
12. Center Electrode
13. Air Cooling Holes, 0.250 Inch Min. Depth.

Igniter Plug Abrasion Wear Limits
Figure 602
(Task 74-22-01-210-001)





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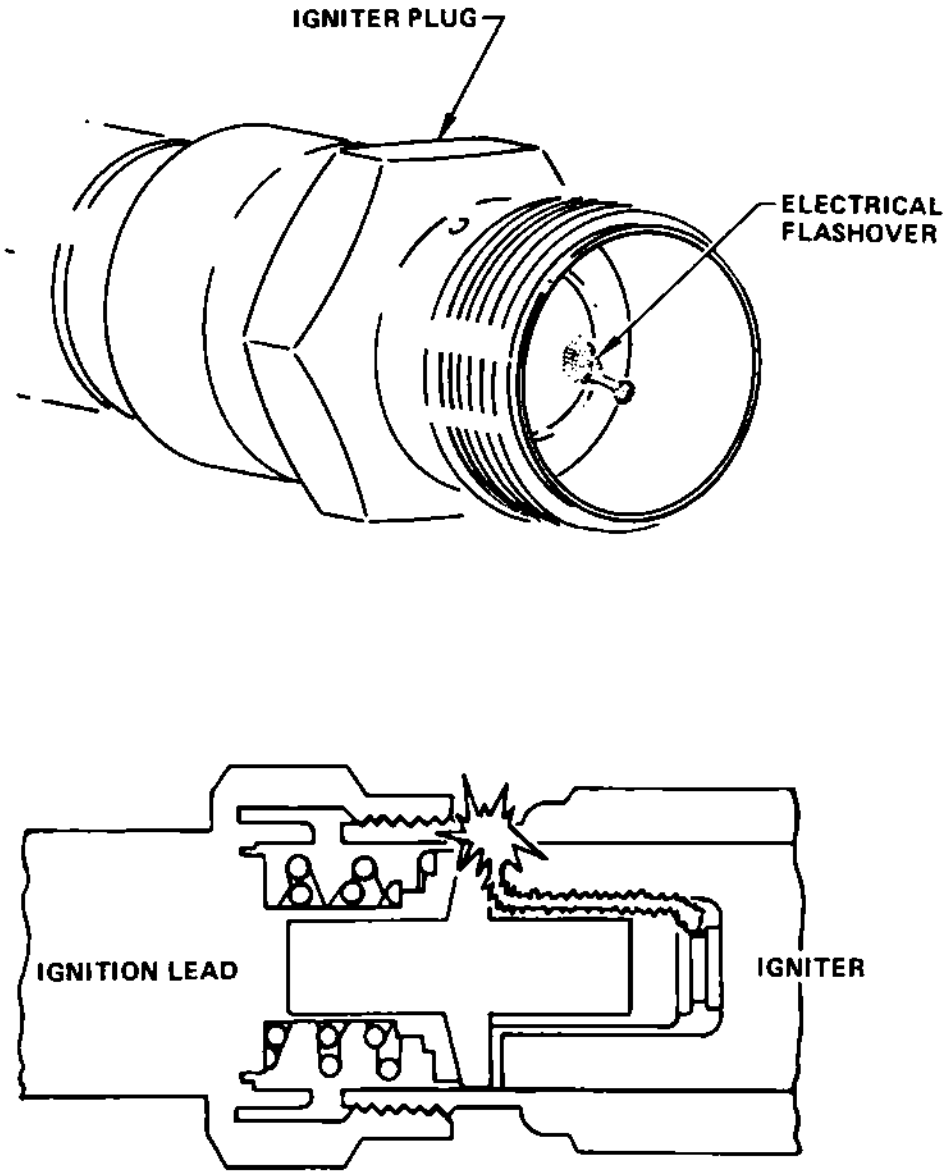
PW V

Igniter Plug Electrical
Arcing Condition
Figure 603
(Task 74-22-01-210-001)



Igniter Plug Electrical
Flashover Condition
Figure 604
(Task 74-22-01-210-001)

IGNITER PLUGS - CLEANING/PAINTING-00

Task 74-22-01-120-001:

1. Cleaning

A. Outer Shell

WARNING: CLEANING SOLVENT IS FLAMMABLE. USE IN A WELL-VENTILATED AREA, AND AVOID CONTACT WITH SKIN. THE IGNITER PLUG MAY CONTAIN RESIDUE OF KRYTOX 240 AC GREASE. DO NOT CONTAMINATE SMOKING MATERIALS (CIGARETTES, CIGARS, ETC.) WITH KRYTOX 240 AC GREASE. COMBUSTION PRODUCTS OF KRYTOX 240 AC GREASE COULD BE HARMFUL IF INHALED. AVOID SKIN CONTACT. WASH HANDS IMMEDIATELY AFTER CONTACT WITH KRYTOX 240 AC GREASE.

NOTE: Cleaning solvent must be SPOP 208. See Chapter/Section 70-00-00, Standard Practices. Cleaning of the recessed center electrode cavity on the firing end of the igniter plug is not recommended.

(1) Degrease the igniter plug in cleaning solvent.

(2) Clean the outer shell of the igniter plug with a wire brush.

(3) Use cleaning solvent and a non-metallic brush to remove deposits from the external surface of the firing end of the igniter plug. It is not necessary to restore ceramic to the cleanness of a new ceramic surface.

B. Contact Well

NOTE: Compressed air must be maintained at 30 psig maximum discharge pressure.

NOTE: Dirt on the contact surface will cause reduced output or arcing.

(1) Remove dirt or foreign matter from inside the contact well with compressed air.

(2) Clean the igniter plug contact well with long a bristle, non-metallic brush moistened by SPOP 208 cleaning solvent. Dry with compressed air. See Chapter/Section 70-00-00, Standard Practices.

(3) Clean the inner ceramic walls with a circular felt bob, 1/2 inch in diameter and approximately 1 3/4 inches long, suitable for use with a hand chuck. Moisten with cleaning solvent and clean with a circular movement of your hand.

(4) Clean the end surface of the ceramic at the seat of the grommet face with a short bristle non-metallic brush moistened with cleaning solvent. Dry with compressed air.

75-00-00

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75-09-01	AIR SHUTOFF VALVE AND ACTUATOR - REMOVAL/INSTALLATION-00 • 75-09-01-450-001: Removal/Installation of Fuel De-Icing Air Shutoff Valve and Actuator • 75-09-01-450-002: Removal/Installation of Anti-Icing Air Shutoff Valve and Actuator
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	Bleed System
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75−31−31	START BLEED CONTROL VALVE − DESCRIPTION−00 • 75−31−31−990−001: Description And Operation Of Start Bleed Control Valve (SB 5425)
75−31−31	START BLEED CONTROL VALVE − REMOVAL/INSTALLATION−00 • 75−31−31−450−001: Removal/Installation Of Start Bleed Control Valve (Engine Incorporating SB 5425)

Task 75-00-00-990-001:

1. Air - Description and Operation

   A. The engine air systems are the anti-icing air system, compressor bleed air system, cooling air system, labyrinth seal air system, internal bleed system, and the fuel de-icing air system. The cooling air system, labyrinth seal air system, and the internal bleed system are integral with the engine and are described in detail in Chapter 72. In the fuel de-icing air system hot compressor discharge air is piped forward from the diffuser section air bleed manifold rear openings (on the diffuser section outer duct) through a de-icing manifold on the top of the engine to an electrically operated air shutoff valve and actuator on the right of the engine. After leaving the valve, the air is piped down to the fuel de-icing heater, adjacent to the fuel pump, and then vented overboard. The fuel de-icing heater is a component of the fuel de-icing system. See Chapter 73-14-01 for a general description of this system.

Pratt & Whitney
JT8D MAINTENANCE MANUAL (PN 481671)

Please insert the revised pages into this manual and delete obsoleted pages in accordance with the following List of Effective Pages. Revised pages are indicated by the letter "R", added pages by the letter "A", and deleted pages by the letter "D". Superseded pages shall be removed and destroyed.

The List of Effective Pages records not only each page of subject revision but also each previously issued page which is still current. Blank pages and pages which are no longer current do not appear on this list. If there is any question about the currency of the maintained copy, it is recommended that each page of the manual be checked off against this List of Effective Pages. Any page which does not check out with this list, either by number or by date, shall be discarded. This list is reissued in its entirety whenever this manual section is revised.

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TO: RECIPIENTS OF JT8D MAINTENANCE MANUAL, PART NUMBER 481671

REVISION NO. 132 DATED OCTOBER 15, 2006

HIGHLIGHTS - 75 - AIR

CHAPTER/ SECTION	PAGE NO	DESCRIPTION OF CHANGE	EFFECT OF CHANGE
75-30-00	603	Added figure to	-ALL
INSP/CK-00	605/ 606	illustrate bleed valve lubrication (CACTUS C6010-Q70686)	

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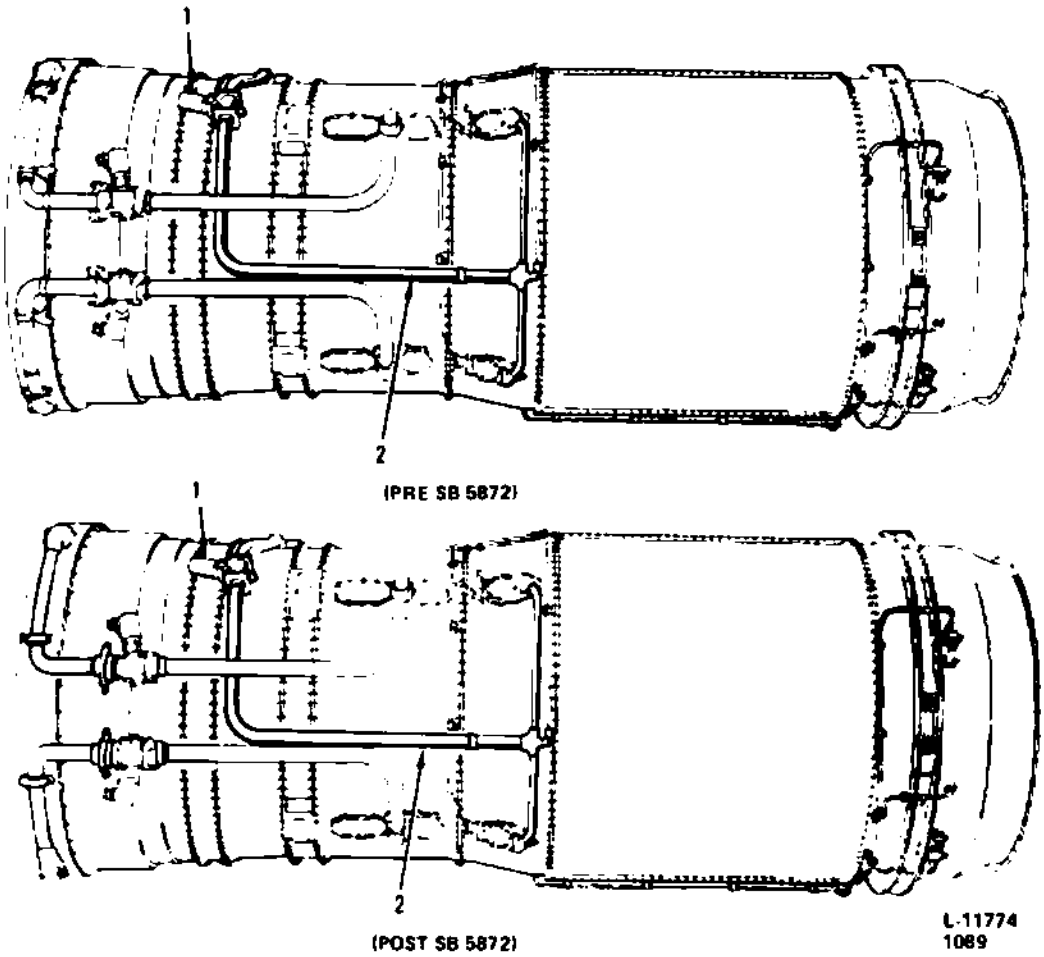
AIR SHUTOFF VALVE AND ACTUATOR - DESCRIPTION-00

Task 75-09-01-990-001:

1. Description and Operation

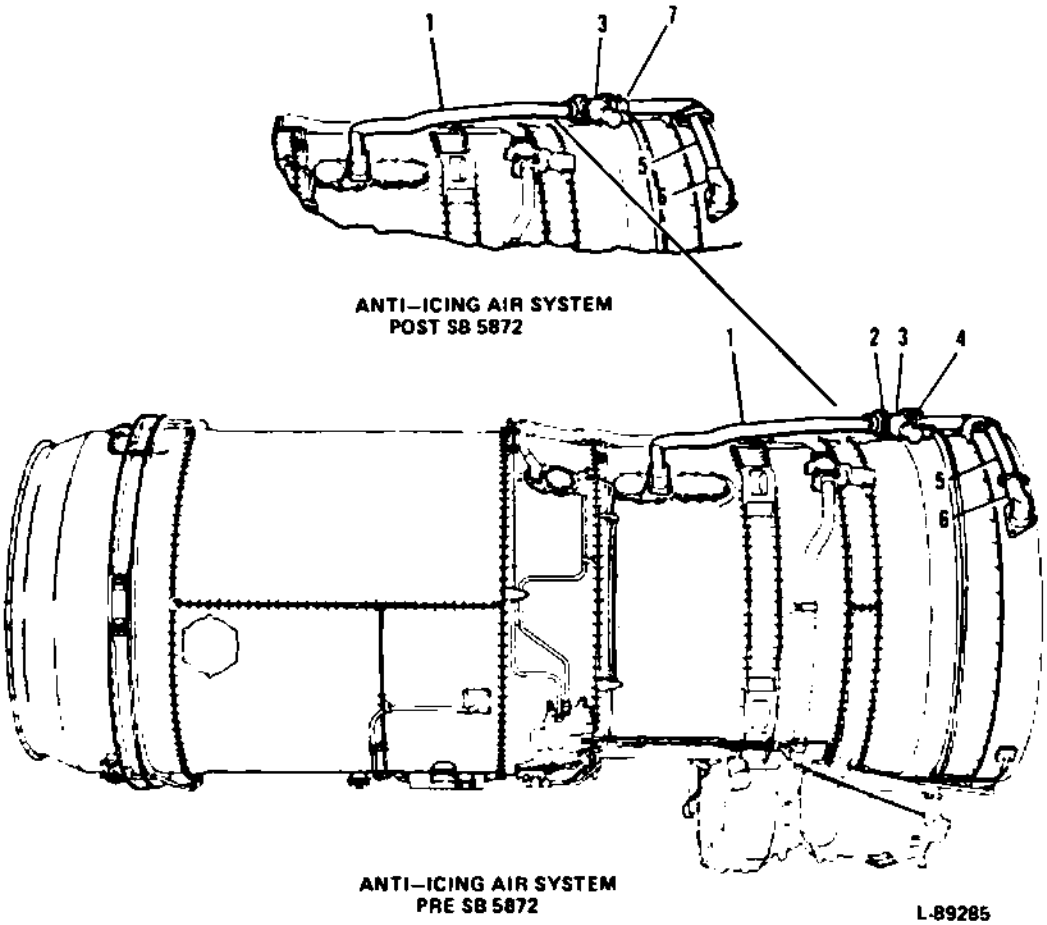
See Figure 1 and Figure 2.

A. There are three valve and actuator assemblies on the engine which can be used to permit passage of high pressure air for air inlet anti-icing and fuel de-icing. The butterfly valves are electrically actuated to be turned on or off. One valve and actuator is located within the fuel de-icing system and the other two are in the left and right air inlet anti-icing systems.



1. Fuel De-Icing Air Shutoff Valve and Actuator.
2. Fuel De-Icing Air Manifold

Fuel De-Icing Air System
Figure 1
(Task 75-09-01-990-001)



1. Rear Anti-Icing Air Tube
2. Anti-Icing Air Regulator Or Metering Plug (As Applicable)
3. Air Shutoff Valve and Actuator
4. Anti-Icing Air Tube Flange
5. Front Anti-Icing Air Tube
6. Anti-Icing Air Tube Elbow
7. Sealing Sleeve

Engine Anti-Icing Air System
Figure 2
(Task 75-09-01-990-001)

AIR SHUTOFF VALVE AND ACTUATOR - REMOVAL/INSTALLATION-00

Task 75-09-01-450-001:

1. Removal/Installation of Fuel De-Icing Air Shutoff Valve and Actuator

A. Removal

(1) Disconnect the wiring harness lead from the air shutoff valve actuator.

(2) Establish clip and bracket locations for installation purposes.

(3) Disconnect the high pressure, bleed control air supply tube from the rear of the de-icing manifold tube.

(4) Unfasten the de-icing manifold at the rear from the diffuser outer duct (both sides) and, at the front, from the eye bracket.

(5) Unfasten the de-icing manifold flange from the shutoff valve upper flange and remove the manifold from the engine.

NOTE: Assemblies with SB 5706 will have a gasket between the valve and actuator and the upper tube flange. Remove this gasket and make a note of the location where the gasket was used.

(6) Disconnect the shutoff valve lower flange from the de-icing air shutoff valve- to-fuel heater tube (lower right) and remove the valve and actuator.

NOTE: Assemblies with SB 5706 will have a gasket between the valve and actuator and the lower tube. Remove this gasket and make a note of the location where the gasket was used. The actuator and valve and the mating fuel de-icing tubes were formerly secured to the engine bracket with two bolts (one bolt through each upper and lower tube eye). On current engines (with SB 5674), the bracket has only one bolthole, so that only one bolt is used; with the former two-hole bracket, the lower bolt may have been omitted to avoid the effects of thermal expansion.

B. Installation

AIR SHUTOFF VALVE AND ACTUATOR - REMOVAL/INSTALLATION-00

(1) Mount the fuel de-icing air shutoff valve and actuator (actuator forward) on the right side of the engine and secure the shutoff valve to the de-icing air shutoff valve-to-fuel heater tube (lower right) with four nuts and bolts.

NOTE: If the assembly incorporates SB 5706, install a gasket between the valve and actuator and the lower tube flange.

(2) Put the de-icing air manifold on top of the engine. Secure it to the eye bracket at the front flange with a bolt, large washer, small washer, and locknut. Secure the manifold to the upper flange of the shutoff valve with four bolts and locknuts.

NOTE: If an assembly incorporates SB 5706, install a gasket between the valve and actuator and the upper tube flange. The actuator and valve and mating fuel de-icing tubes were formerly secured to the engine bracket with two bolts (one bolt through each upper and lower tube eye). On current engines (with SB 5674), the bracket has only one bolthole, so that only one bolt is used; with the former two-hole bracket, the lower bolt may be omitted to avoid effects of thermal expansion.

(3) Connect the de-icing manifold tube to the diffuser outer duct at the top on both sides with two bolts, a nut, a new washer and new gasketon each side.

(4) Connect the high pressure, bleed control air supply tube to the rear of the de-icing manifold tube.

(5) Tighten the nuts and bolts to the recommended torque and lockwire.

(6) Install clips and brackets.

(7) Connect the wiring harness lead to the air shutoff valve actuator.

Task 75-09-01-450-002:

2. Removal/Installation of Anti-Icing Air Shutoff Valve and Actuator

A. General

(1) The anti-icing air system has two assemblies located on the left and right sides of the engine. The replacement procedure is the same for both valves and actuators.

B. Removal (Pre SB 5872)
See Figure 401.

(1) Establish clamp locations to make the installation easier.

(2) Disconnect the electrical lead to anti-icing air shutoff valve.

(3) Remove three nuts and washers which attach the anti-icing air tube from the engine.

(4) Remove nuts and bolts which hold the valve support to the front compressor case bracket by one of the following:

(5) Unfasten the bolts from the front flange of the air shutoff valve and remove the support.

(a) Before SB 5666: Loosen and remove the bolts, locknuts and washers.

NOTE: Assemblies before SB 3218 will have key washers under the boltheads. Unbend the tabs of these key washers and discard the key washers after you remove the bolts.

(b) Incorporating SB 5666: Loosen and remove the bolts, locknuts and washers. Drift out the bushing (Index 7 in the figure) at each side of the valve support.

(6) Remove the bolts which attach the rear flange of the valve to the anti-icing air regulator, then remove the valve and actuator.

NOTE: Assemblies before SB 1536 will have either an anti-icing air regulator (Index 2) or a metering

plug (Index 3) in the forward end of the rear anti-icing tube. Assemblies which incorporate SB 5706 will have gaskets (Index 9) between the valve and actuator and the mating tube or support surface. Remove these gaskets and make a note of the locations where the gaskets were used.

C. Removal (Post SB 5872)
See Figure 402.

NOTE: The anti-icing system has two assemblies located on the left and right side of the engine. The removal procedure is the same for each valve and actuator.

(1) Make a record of the clamp locations to make installation easier.

(2) Remove the electrical lead to the anti-icing air shutoff valve.

(3) Loosen and remove the three bolts and washers from the front anti-icing tube elbow.

(4) Loosen and remove the two bolts that attach the half clamp to the front anti-icing tube.

NOTE: PN 804011 bottom clamp half has nuts that are loose. PN 809185 clamp half has nuts welded to the clamp. See Figure 404.

(5) Loosen and remove the two bolts and nuts that attach the half clamp to the sealing sleeve.

(6) Loosen and remove the bolts, nuts, and washers that attach the valve and actuator to the sealing sleeve.

(7) Loosen and remove the bolts, nuts, and washers that attach the valve and actuator to the rear anti-icing tube assembly and remove the valve and actuator.

D. Installation (Pre SB 5872)
See Figure 401.

AIR SHUTOFF VALVE AND ACTUATOR - REMOVAL/INSTALLATION-00

(1) Position valve and actuator on rear anti-icing air tube and secure with four bolts. Tighten bolts to recommended torque and lockwire.

NOTE: If assembly is prior to SB 1536, install either anti-icing air regulator (Index 2 in figure) or metering plug (Index 3 in figure) in forward end of rear anti-icing tube as applicable. If assembly incorporates SB 5706, install gasket (Index 9 in figure) between valve and actuator and rear tube.

(2) Fasten valve support to front flange of valve with four bolts, washers, and locknuts. Tighten locknuts to recommended torque.

NOTE: If assembly incorporates SB 5706, install gasket (Index 9 in figure) between valve and actuator and support.

(3) Secure support to front compressor case bracket with nuts and bolts per one of the following:

(a) Prior to SB 5666: Install bolts and locknuts through support and engine bracket, with washer under each bolthead and locknut. Torque bolts and nuts.

NOTE: Assembly prior to SB 3218 will incorporate hex-head bolts with key washers (Index 8 in figure) under boltheads in place of plain washers. On this type of assembly install key washers under boltheads and install so that tab of key washer enters hole in engine bracket. Bend tabs of key washers against flat of bolthead after bolts and nuts are torqued.

(b) Incorporating SB 5666: Position support between lugs of engine bracket and install bushing (Index 7 in figure) through lugs of bracket and support at each side from front. Install bolts (with washers under boltheads) through bushings from front and secure with washers and locknuts. Torque bolts and nuts.

(4) Insert front anti-icing air tube into valve support.

(5) Secure anti-icing air elbow, attached to front anti-icing air tube, to inlet case using a new gasket, three washers and locknuts. Tighten locknuts to recommended torque.

(6) Secure front tube with clip.

(7) Connect electrical lead to air valve.

E. Installation (Post SB 5872)
See Figure 402.

NOTE: The anti-icing system has two assemblies located on the left and right side of the engine. The installation procedure is the same for each valve and actuator.

(1) Attach the valve and actuator to the rear anti-icing tube with four bolts, nuts, and washers. Tighten the bolts to the recommended torque.

(2) Attach the valve and actuator to the sealing sleeve flange on the front anti-icing tube with the four bolts, washers, and locknuts. Tighten the locknuts to the recommended torque.

(3) Attach the half clamp on the sealing sleeve with bolts to brackets on Flange C.

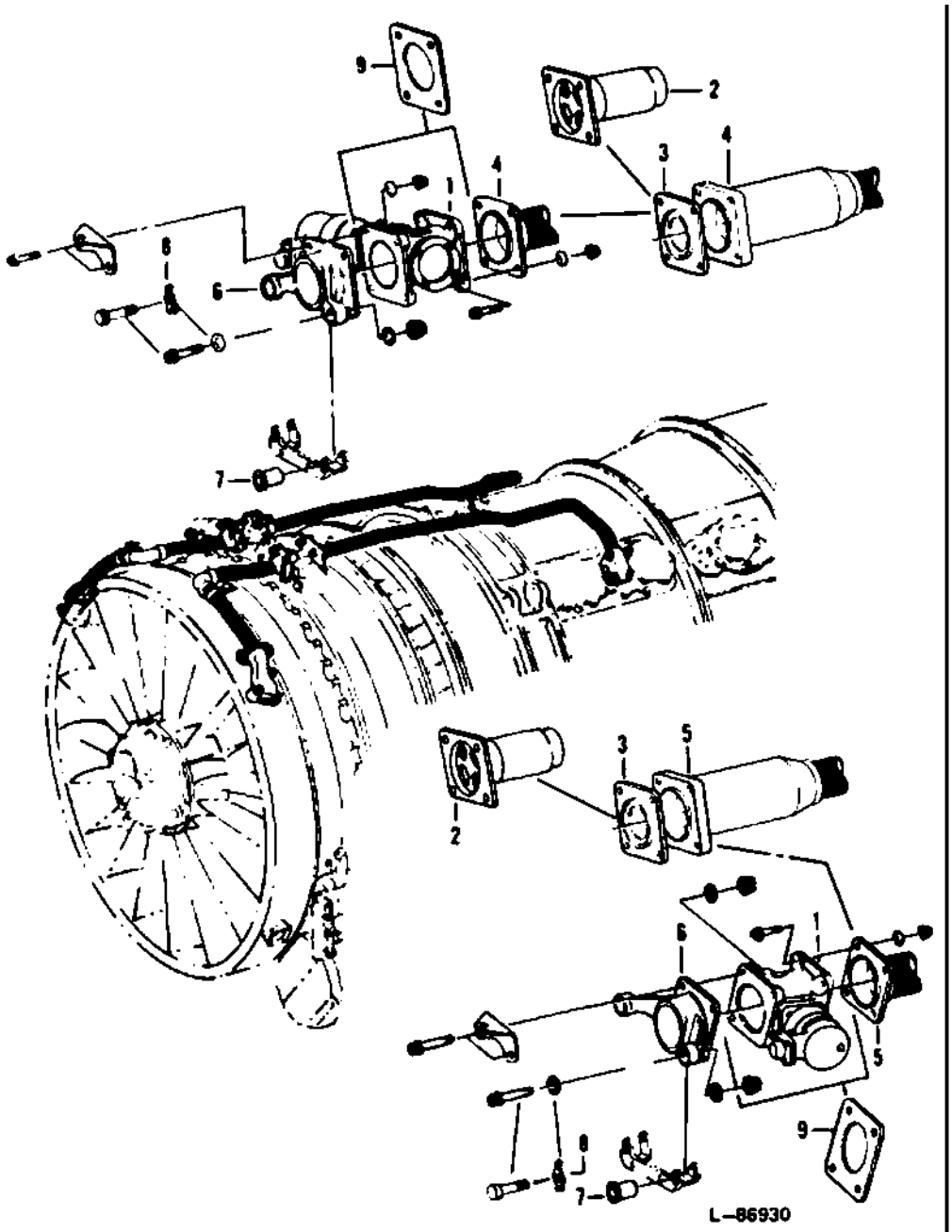
NOTE: With PN 804011 bottom clamp half the nuts are loose. PN 809185 clamp half has nuts welded to the clamp.

(4) Attach the clamp, bolts, and nuts to the front anti-icing tube.

(5) Attach the front anti-icing tube elbow with a new gasket with the washers and bolts to the inlet case. Tighten the bolts to the recommended torque and lockwire.

(6) Tighten the bolts (or locknuts) on the clamps and half clamp to the recommended torque.

(7) Attach the electrical lead to the air shutoff valve.



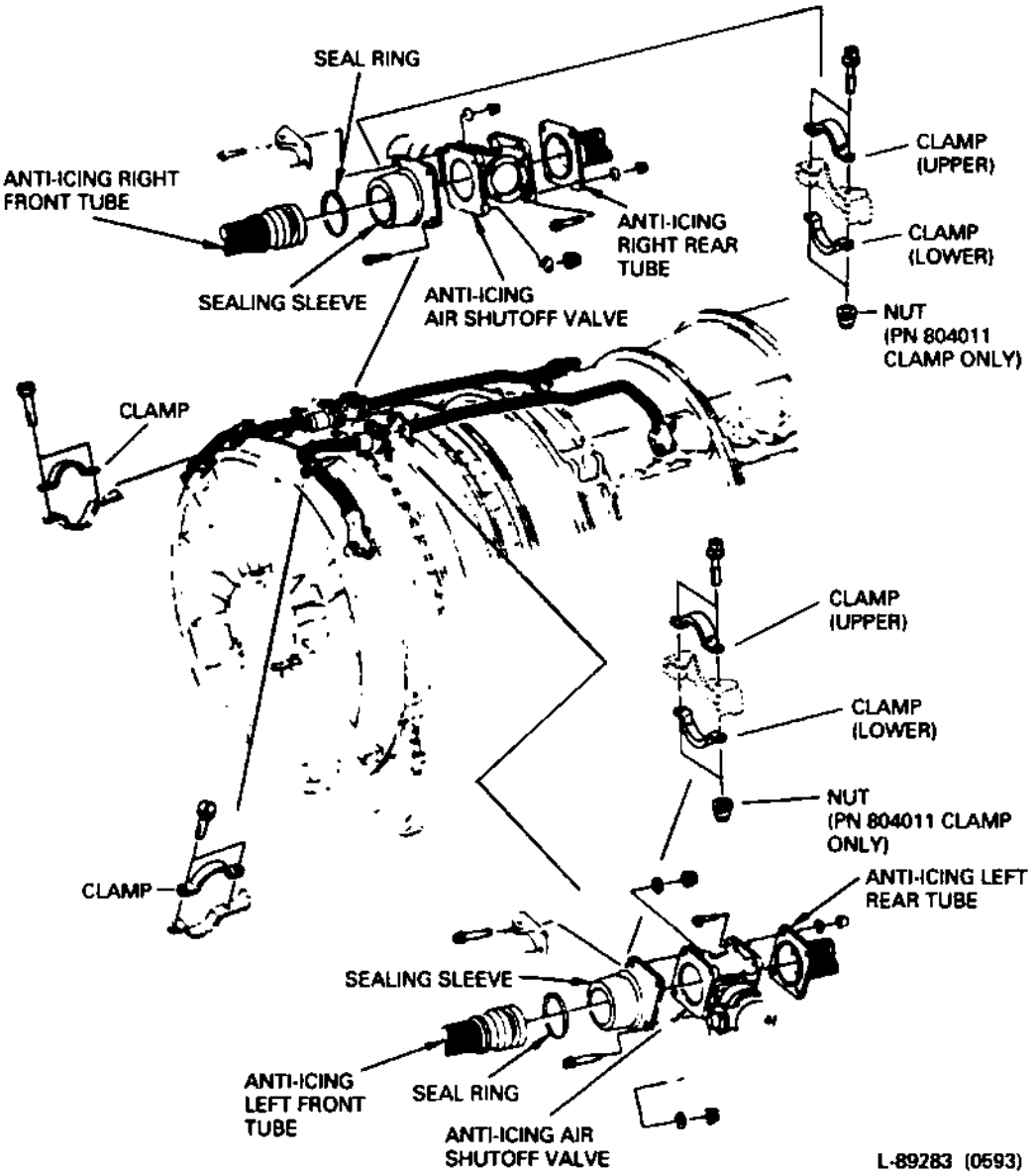
Anti-Icing Air Shutoff
Valve Removal/Installation
Figure 401
(Task 75-09-01-450-002)

AIR SHUTOFF VALVE AND ACTUATOR - REMOVAL/INSTALLATION-00

1. Anti-Icing Air Shutoff Valve
2. Anti-Icing Regulator
3. Metering Plug
4. Anti-Icing Right Rear Tube
5. Anti-Icing Left Rear Tube
6. Air Shutoff Valve Support
7. Bushing (Two Per Side)
8. Key Washer (See Text)
9. Gasket (Up To Two Per Valve) (See Text)

Key to Figure 401

AIR SHUTOFF VALVE AND ACTUATOR - REMOVAL/INSTALLATION-00



Anti-Icing Air Shutoff
Valve Removal/Installation
Figure 402
(Task 75-09-01-450-002)

ANTI-ICING AIR SYSTEM - DESCRIPTION-00

Task 75-10-00-990-001:

1. Description and Operation of Anti-Icing Air System

   A. In order to prevent undesirable icing of the engine air inlet surfaces, an anti-icing air system is incorporated in the engine. The principal components of the system are the two air shutoff valve and actuator assemblies, the two regulators, and appropriate tubing.

   B. Hot air (eighth stage) is bled from each side of the rear compressor and is piped forward to the inlet section. From the outer annulus of the compressor inlet case, into which the heated air is piped, the air flows inward through the hollow compressor inlet vanes to an inner annulus.

ANTI-ICING AIR SYSTEM - TROUBLESHOOTING-00

Task 75-10-00-810-001:

1. General

   A. See Chapter/Section 72-00-00, Troubleshooting-01 for fault isolation procedures on anti-icing air system.

Task 75-10-00-450-001:

1. Removal/Installation of the Anti-Icing Air System (Pre SB 5872)

See Figures 401 and 402.

A. General

(1) The anti-icing air system has two assemblies located on the left and right sides of the engine. Tubes extend from the elbows located on the sides of the rear compressor outer duct to the elbows located at the upper quadrants of the inlet case. The replacement procedure is the same for either side.

B. Removal
See Figure 402.

(1) Establish clamp locations to make the installation easier.

(2) Disconnect the electrical lead to anti-icing air shutoff valve.

(3) Remove the clips, then unfasten the bolts at the inlet case elbow.

(4) Remove the three nuts and then remove the elbow from the inlet case.

(5) Remove the front anti-icing tube.

(6) Remove the nuts and bolts which hold the valve support to the front compressor case bracket by one of the steps that follow:

(a) Prior to SB 5666: Loosen and remove the bolts, locknuts and washers.

NOTE: Assemblies before SB 3218 will have key washers under the boltheads. Unbend the tabs of these key washers and discard the key washers after you remove the bolts.

(b) Incorporating SB 5666: Loosen and remove the bolts, locknuts and washers. Drift out the bushing (Index 7) at each side of the valve support.

(7) Unfasten the bolts from the front flange of the anti-icing air shutoff valve and remove the support.

(8) Unfasten the bolts at the valve assembly rear flange and remove the valve and actuator.

NOTE: Assemblies before SB 1536 will have either an anti-icing air regulator (Index 2) or a metering plug (Index 3) in the forward end of the rear anti-icing tube. Remove the regulator or metering plug as applicable. Assemblies with SB 5706 will incorporate gaskets (Index 9) between the valve and actuator and the mating tube or support surface. Remove these gaskets and make a note of the locations where the gaskets were used.

(9) Unfasten bolts which attach the rear anti-icing air tube to the rear compressor outer duct. Remove the tube.

C. Installation
See Figure 402.

(1) Assemble the air valve to the rear tube with four bolts. Tighten the bolts to the recommended torque and lockwire.

NOTE: If the assembly is before SB 1536, install either an anti-icing air regulator (Index 2) or a metering plug (Index 3) in the forward end of the rear anti-icing tube as applicable. If the assembly has SB 5706, install a gasket (Index 9) between the valve and actuator and the rear tube.

(2) Install the assembled rear tube and valve on the engine. Use a new gasket on the rear compressor outer duct boss. Fasten the rear tube to the boss with four washers and bolts. Tighten the bolts to the recommended torque and lockwire.

(3) Fasten the valve support to the front flange of the valve with four bolts, washers, and locknuts. Tighten the locknuts to the recommended torque.

NOTE: If an assembly incorporates SB 5706, install a gasket (Index 9) between the valve and actuator and the support.

(4) Attach the support to the front compressor case bracket with nuts and bolts by one of the steps that follow:

(a) Before SB 5666: Install the bolts and locknuts through the support and the engine bracket, with a washer under each bolthead and locknut. Torque the bolts and nuts.

NOTE: Assemblies before SB 3218 will have hexhead bolts with key washers (Index 8) under boltheads in place of plain washers. On this type of assembly, install key washers under the boltheads and install them so that the tab of the key washer enters the hole in the engine bracket. Bend the tabs of the key washers against the flat of the bolthead after the bolts and nuts are torqued.

(b) With SB 5666: Put the support between the lugs of the engine bracket and install the bushing (Index 7) through the lugs of the bracket and support at each side from the front. Install the bolts (with washers under the boltheads) through the bushings from the front and secure them with washers and locknuts. Torque the bolts and nuts.

(5) Install the front anti-icing tube into the flange.

(6) Attach the inlet case elbow to the front tube with two bolts, four washers, and two locknuts. Tighten nuts to the recommended torque.

(7) Attach the elbow to the inlet case with a new gasket, three washers and locknuts. Tighten locknuts to the recommended torque.

(8) Attach the front tube with a clip.

(9) Connect the electrical lead to the air valve.

Task 75-10-00-450-002:

2. Removal/Installation Of The Anti-Icing Air System (Post SB 5872)

A. Removal
See Figures 403 and 404.

NOTE: The anti-icing system has two assemblies located on the left and right side of the engine. Tubes extend from the elbows located on the sides of the rear compressor outer duct to the elbows located on the upper area of the inlet case. The procedure for replacement is the same for both sides. These procedures are also applicable to the anti-icing tubes used with the respaced inlet configuration (RIGV) post-SB 5948.

(1) Make a record of the clamp locations to make installation easier.

(2) Remove the electrical lead to the anti-icing air shutoff valve.

(3) Loosen and remove the three bolts and washers from the front anti-icing tube elbow.

(4) Loosen and remove the two bolts that attach the clamp to the front anti-icing tube.

(5) Loosen and remove the two bolts that attach the half clamp to the sealing sleeve.

NOTE: PN 804011 bottom clamp half have nuts that are loose. PN 809185 clamp half has nuts welded to the clamp. See Figure 404.

(6) Loosen and remove the bolts, nuts, and washers that attach the valve and actuator to the sealing sleeve and remove the front anti-icing tube from the engine.

(7) Loosen and remove the bolts, nuts, and washers that attach the valve and actuator to the rear anti-icing tube assembly and remove the valve and actuator.

(8) Loosen and remove the bolts and washers that attach the rear anti-icing tube to the rear compressor outer duct and remove the tube.

B. Installation
See Figures 403 and 404.

(1) Attach the valve and actuator to the rear anti-icing tube with four bolts, nuts, and washers. Tighten the bolts to the recommended torque.

(2) Install the assembled rear tube and valve on the engine with a new gasket on the rear compressor outer duct boss. Attach the rear tube to the boss with four washers and bolts. Tighten the bolts to the recommended torque and lockwire.

(3) Attach the valve and actuator to the sealing sleeve flange on the front anti-icing tube with the four bolts, washers, and locknuts. Tighten the locknuts to the recommended torque.

(4) Attach the half clamp on the sealing sleeve with bolts to the brackets on Flange C.

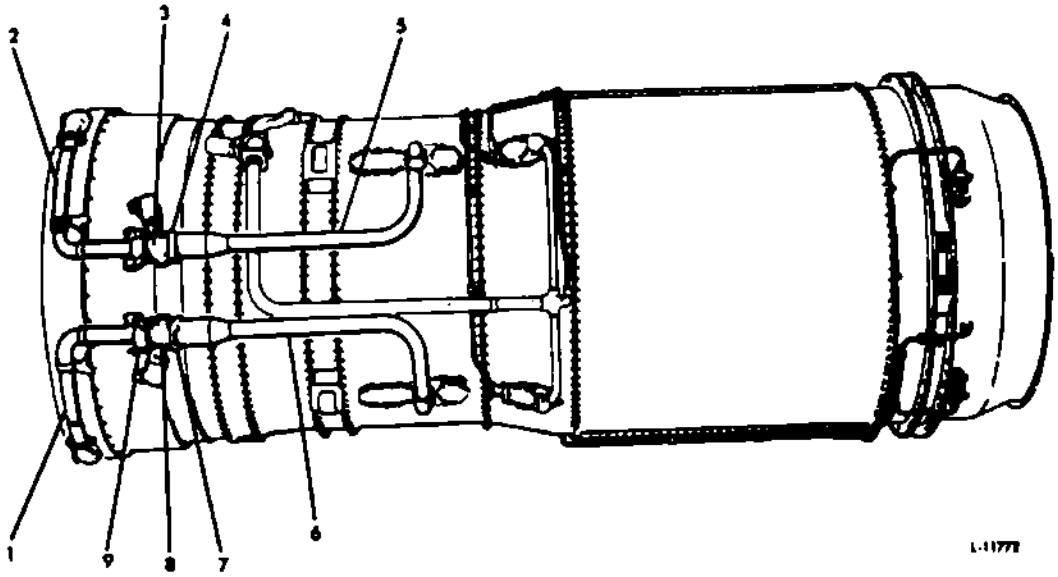
NOTE: PN 804011 bottom clamp half have nuts that are loose. PN 809185 clamp half has nuts welded to the clamp. See Figure 404.

(5) Attach the clamp, bolts, and nuts to the front anti-icing tube.

(6) Attach the front anti-icing tube elbow with a new gasket with the washers and bolts to the inlet case. Tighten the bolts to the recommended torque and lockwire.

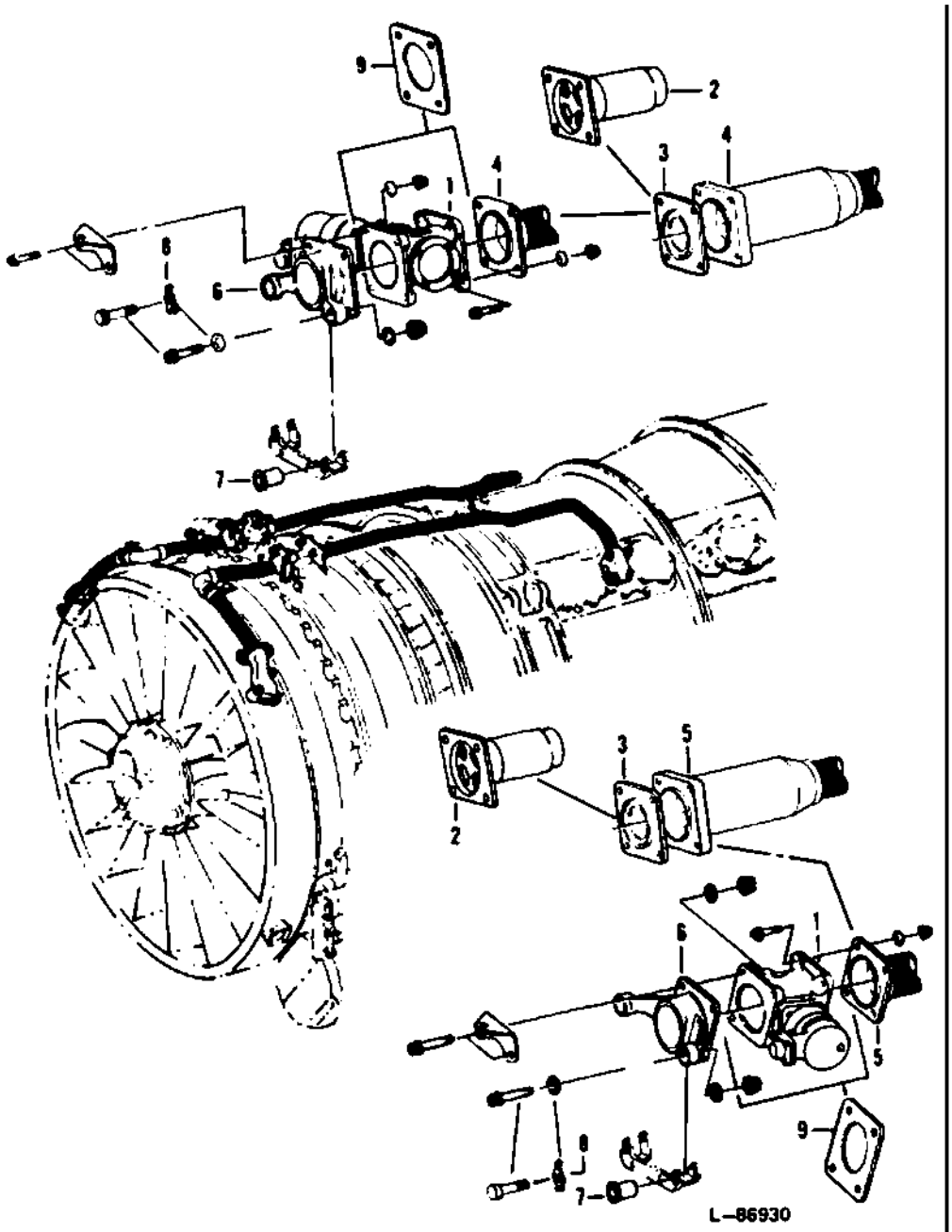
(7) Tighten the bolts (or locknuts) on the clamps and half clamp to the recommended torque.

(8) Attach the electrical lead to the air shutoff valve.



1. Anti-Icing Left Front Tube Assembly
2. Anti-Icing Right Front Tube Assembly
3. Air Shutoff Valve Assembly
4. Anti-Icing Regulator (Or Metering Plug) (If So Equipped)
5. Anti-Icing Air Right Rear Tube Assembly
6. Anti-Icing Air Left Rear Tube Assembly
7. Anti-Icing Regulator (Or Metering Plug) (If So Equipped)
8. Air Shutoff Valve Assembly
9. Air Shutoff Valve Support

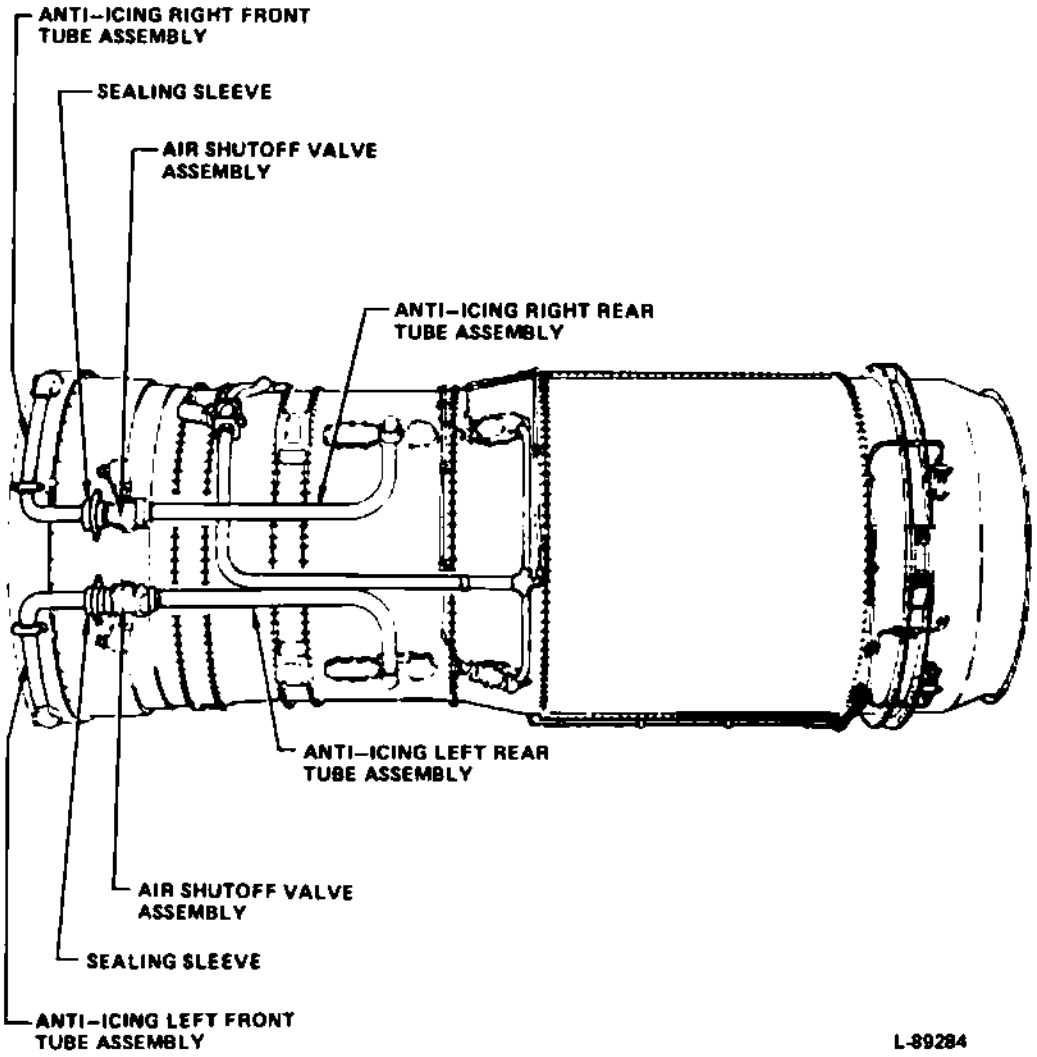
Anti-Icing Air Tubing
Figure 401
(Task 75-10-00-450-002)



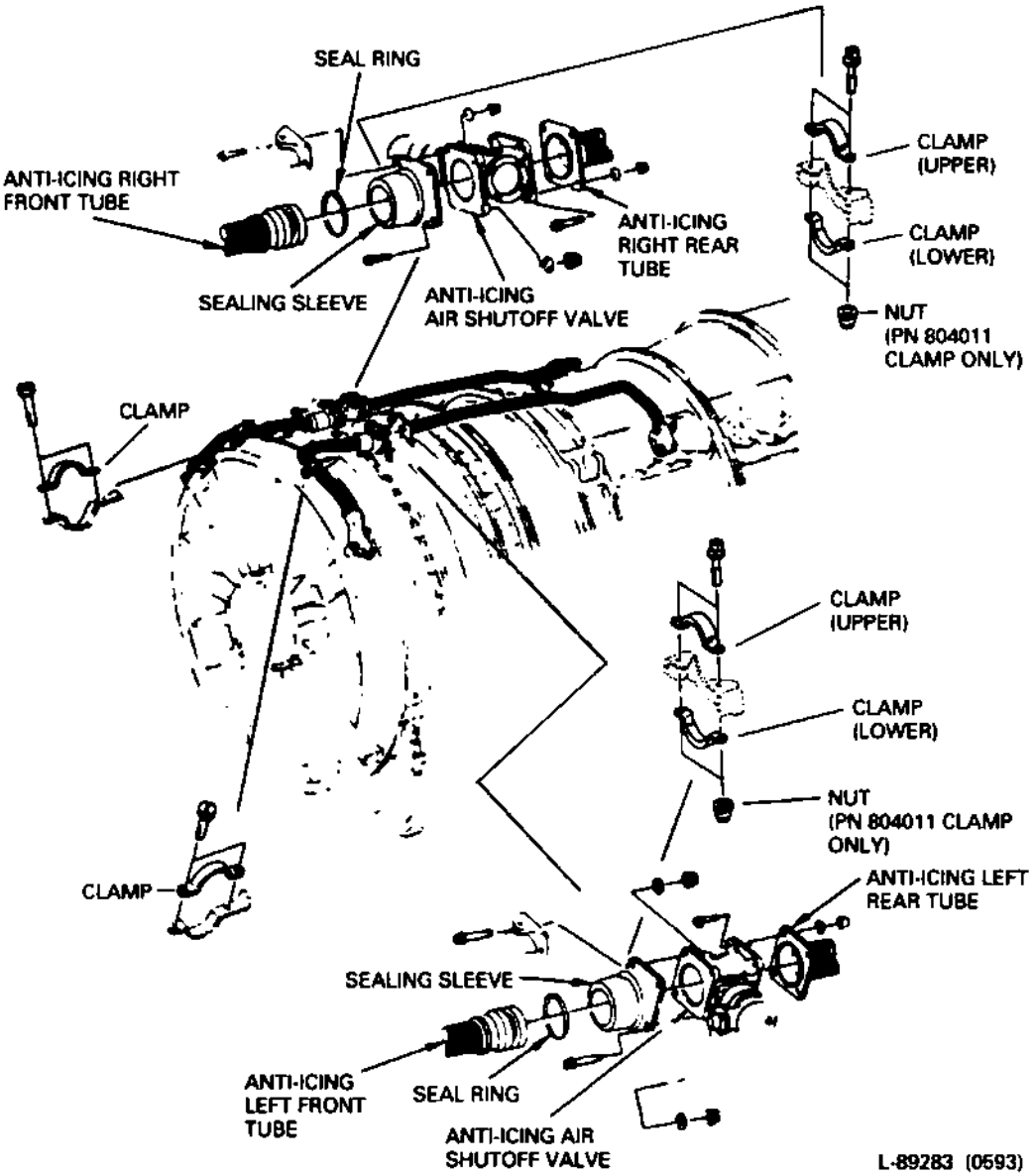
Anti-Icing Air Shutoff
Valve Removal/Installation
Figure 402
(Task 75-10-00-450-002)

1. Anti-Icing Air Shutoff Valve
2. Anti-Icing Regulator
3. Metering Plug
4. Anti-Icing Right Rear Tube
5. Anti-Icing Left Rear Tube
6. Air Shutoff Valve Support
7. Bushing (Two Per Side)
8. Key Washer (See Text)
9. Gasket (Two For Each Valve) (See Text)

Key to Figure 402



Anti-Icing Air Tubing
Figure 403
(Task 75-10-00-450-002)



Anti-Icing Air Shutoff
Valve Removal/Installation
Figure 404
(Task 75-10-00-450-002)

Task 75-10-00-210-001:

1. Periodic Inspection

A. General

(1) These inspection procedures are a normal function of operating organizations and consist of a periodic functional check. The nature and conditions of engine operation determine the time interval between functional inspections.

(2) Engine compartment cleanliness is important because the extensive mass air flow tends to draw foreign objects into the engine. Thoroughly clean the entire engine compartment with a vacuum cleaner after completion of any work. Keep the compartment free of dirt, oil and grease, and remove any small unused parts, such as nuts, washers, and pieces of lockwire. Immediately cover all apertures resulting from the disconnection of tubing or parts.

(3) Carefully inspect the air systems without dismantling to ensure that all connections are tight and free from leaks and that lines, tubing, and controls are secure.

ANTI-ICING AIR REGULATOR - DESCRIPTION-00

Task 75-11-01-990-001:

1. General

A. During periods of anti-icing system operation, restrictive metering orifices in the left and right anti-icing air tubes control hot air flow into the engine inlet and minimize loss of engine thrust. The metering orifices are in the form of either separate metering plugs assembled at the anti-icing air regulator flanges, or restrictive openings incorporated in each of the rear anti-icing air tubes.

ANTI-ICING AIR REGULATOR - REMOVAL/INSTALLATION-00

Task 75-11-01-450-001:

1. Removal/Installation of Anti-Icing Air Regulator or Metering Plug

A. General

(1) The anti-icing air system has two identical, but opposite assemblies located on the left and right sides of the engine. The replacement procedure is the same for either tube.

B. Removal

(1) Remove the bolts which attach the rear anti-icing air tube to the rear compressor outer duct.

(2) Remove the four bolts which attach the air shutoff valve to the rear anti- icing air tube. Remove the tube from the engine.

(3) If applicable, remove the metering plug from the large opening of the rear tube.

C. Installation

(1) If applicable, install the metering plug into the large opening of the rear tube.

NOTE: For uniform diameter anti-icing air tubes, no metering plug is necessary.

(2) Install the assembled rear tube on the rear compressor outer duct boss with a new gasket, four washers and bolts. Tighten bolts to the recommended torque and lockwire.

(3) Attach the assembled tube to the air shutoff valve with four bolts. Tighten bolts to the recommended torque and lockwire.

COMPRESSOR BLEED SYSTEM - DESCRIPTION-00

Task 75-30-00-990-001:

1. Description and Operation of Compressor Bleed System

See Figures 1 through 3.

A. General

(1) The compressor bleed air system is primarily designed to permit operational flexibility by allowing high compressor discharge air to bleed into the fan discharge duct.

(2) In current JT8D engines this is done by two basic arrangements of 8th and 13th stage bleed valves:

(a) Before SB 5425: Two 13th stage bleed valves (at the four and seven o'clock positions on the annulus of the diffuser case) bleed compressor discharge air (Ps4) into the fan stream. On current engines an additional, single 8th stage bleed valve on the rear compressor case (acting in unison with the 13th stage valves) bleeds 8th stage compressor air into the fan stream. Actuating air (Ps4) to the 8th and 13th stage bleed valves is interrupted by the pressure ratio bleed control.

(b) Incorporating SB 5425: One 13th stage bleed valve (at the four o'clock position on the annulus of the diffuser case) bleeds compressor discharge air (Ps4) into the fan stream. Three 8th stage bleed valves on the rear compressor case bleed 8th stage compressor air into the fan stream. Both the 13th stage bleed valve and the 8th stage bleed valves are actuated by Ps4 air; actuating air to the 13th stage bleed valve is interrupted by the start bleed control valve (see Figure 3), and actuating air to the 8th stage bleed valves is interrupted by the pressure ratio bleed control.

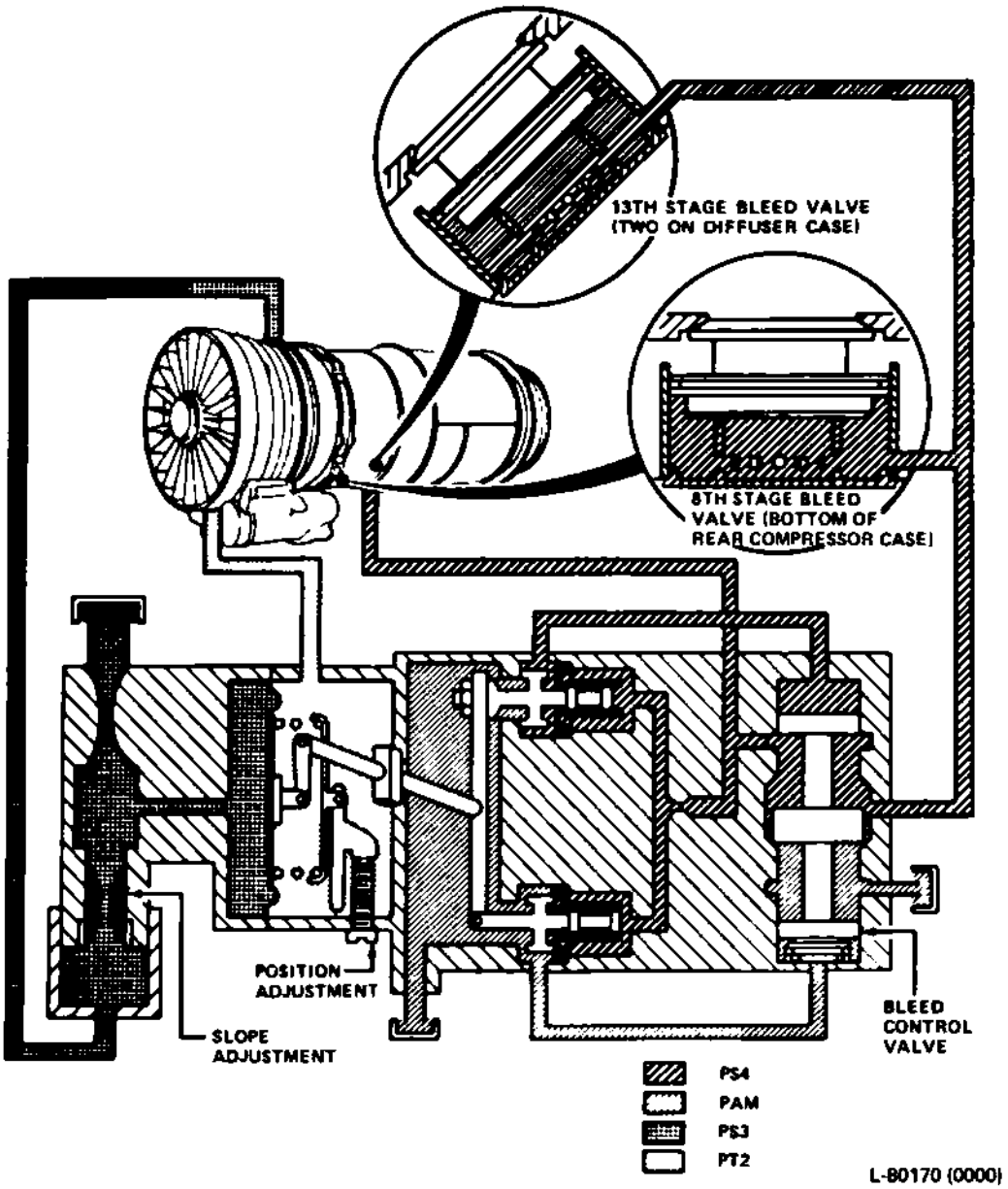
(3) In the static position (engine not running) bleed valves can be either open or closed, depending upon gravity and/or drag caused by contact of the valves with the cylinder walls. During engine operation, compressor discharge air pressure exerted on the valve faces acts to force valves into the open position.

B. Pressure Ratio Bleed Control

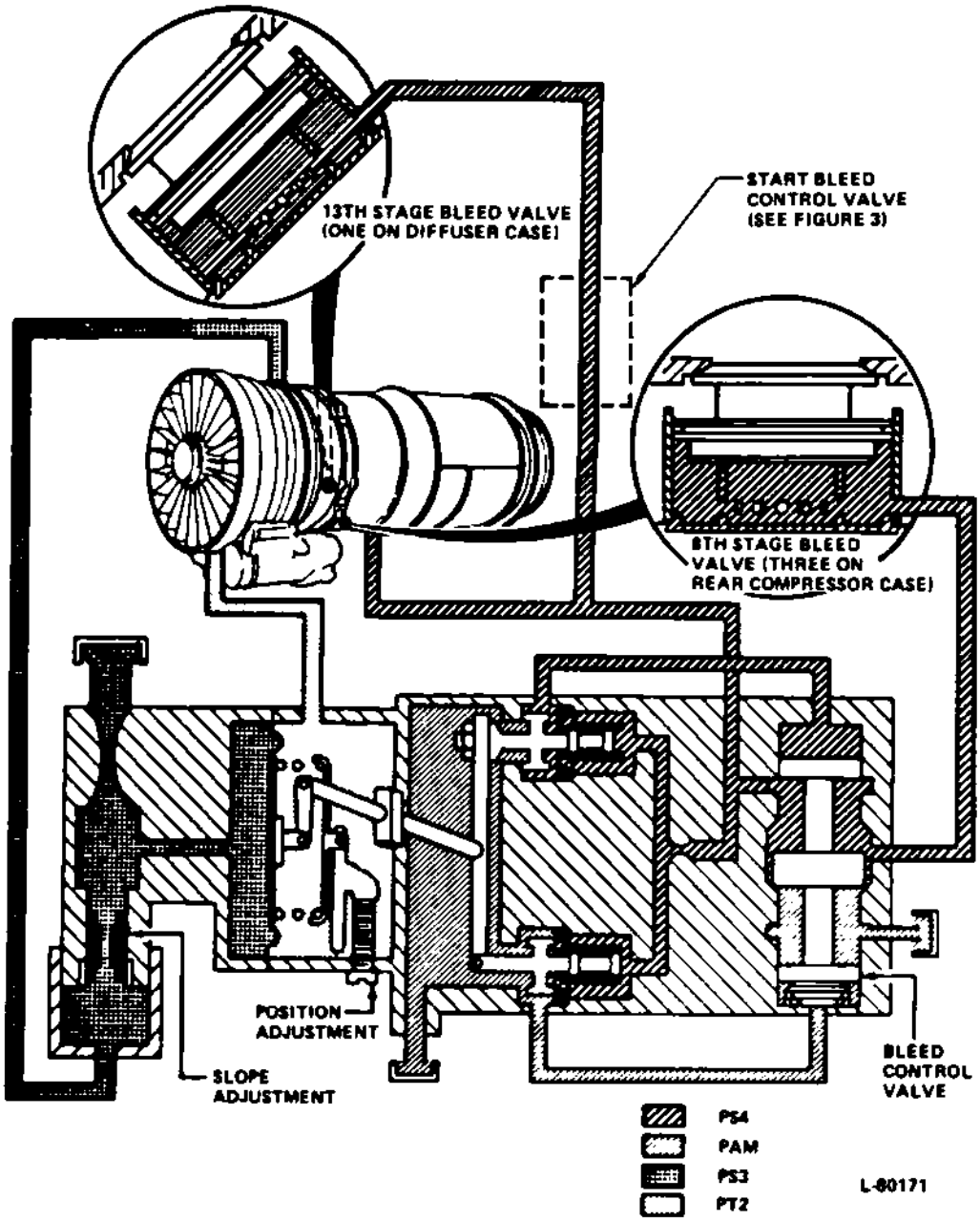
(1) When Ps3 pressure on one side of the diaphragm in the pressure ratio bleed control increases to the point where it overcomes combined Pt2 and spring pressure forces, the poppet valves in the control reverse position, the muscle valve transfers, and Ps4 actuating air is directed to the back side of bleed valves. This Ps4 air acting on the larger area of the back side of the valves is sufficient to overcome compressor discharge air acting on the valve faces and the valves close. When the Ps3/Pt2 differential pressure decreases, the procedure is reversed. Ps4 actuating pressure on the back side of the valves is reduced to ambient, and internal engine pressure forces bleed valves open. See Chapter/Section 75-31-01, Description And Operation.

C. Start Bleed Control Valve

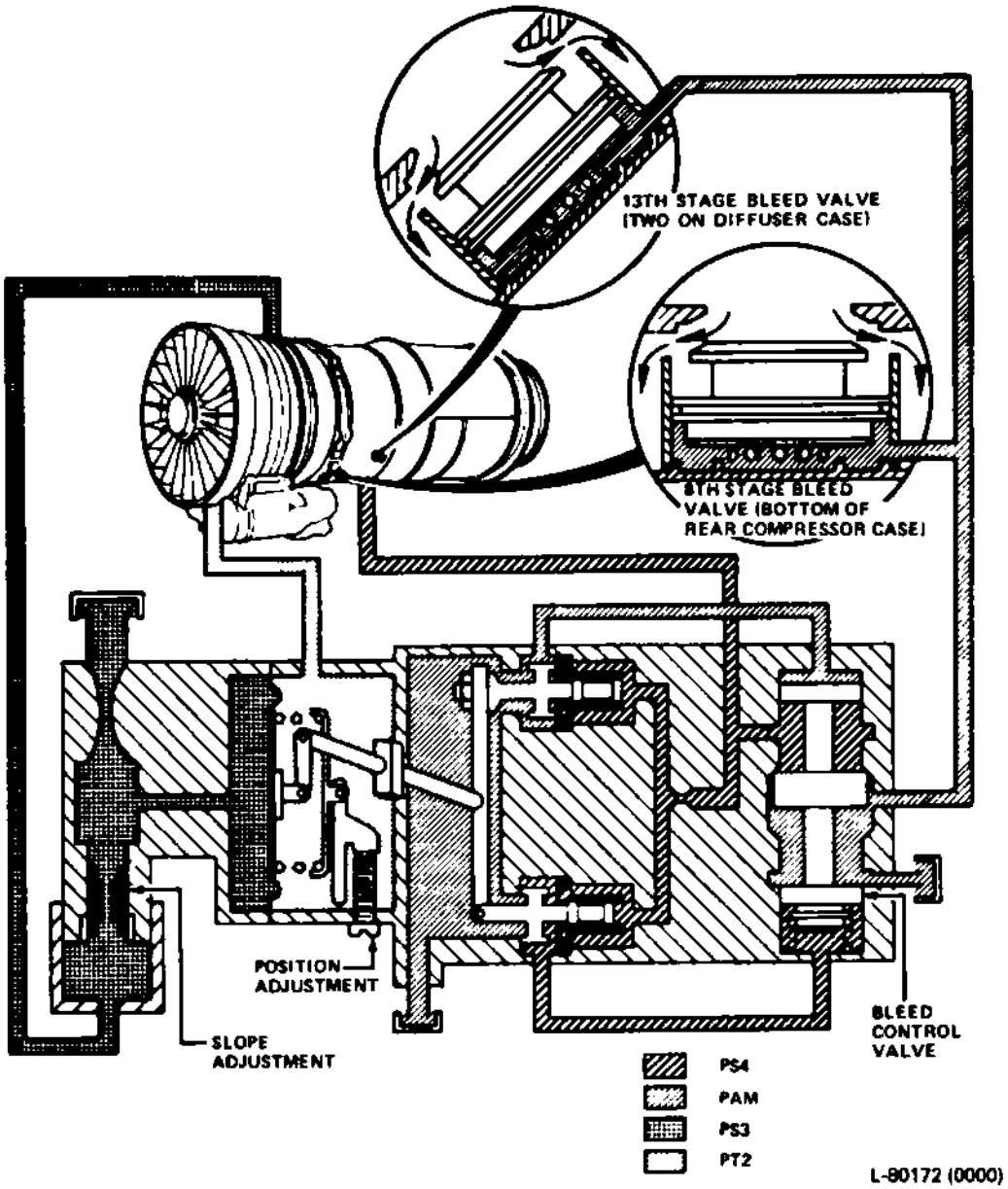
(1) With the engine shut down or starting up, spring pressure forces a poppet valve closed. As Ps4 pressure increases during the starting cycle, valve closing pressure is overcome and Ps4 air proceeds into the engine, closing the 13th stage bleed valve. See Chapter/Section 75-31-31, Description And Operation.



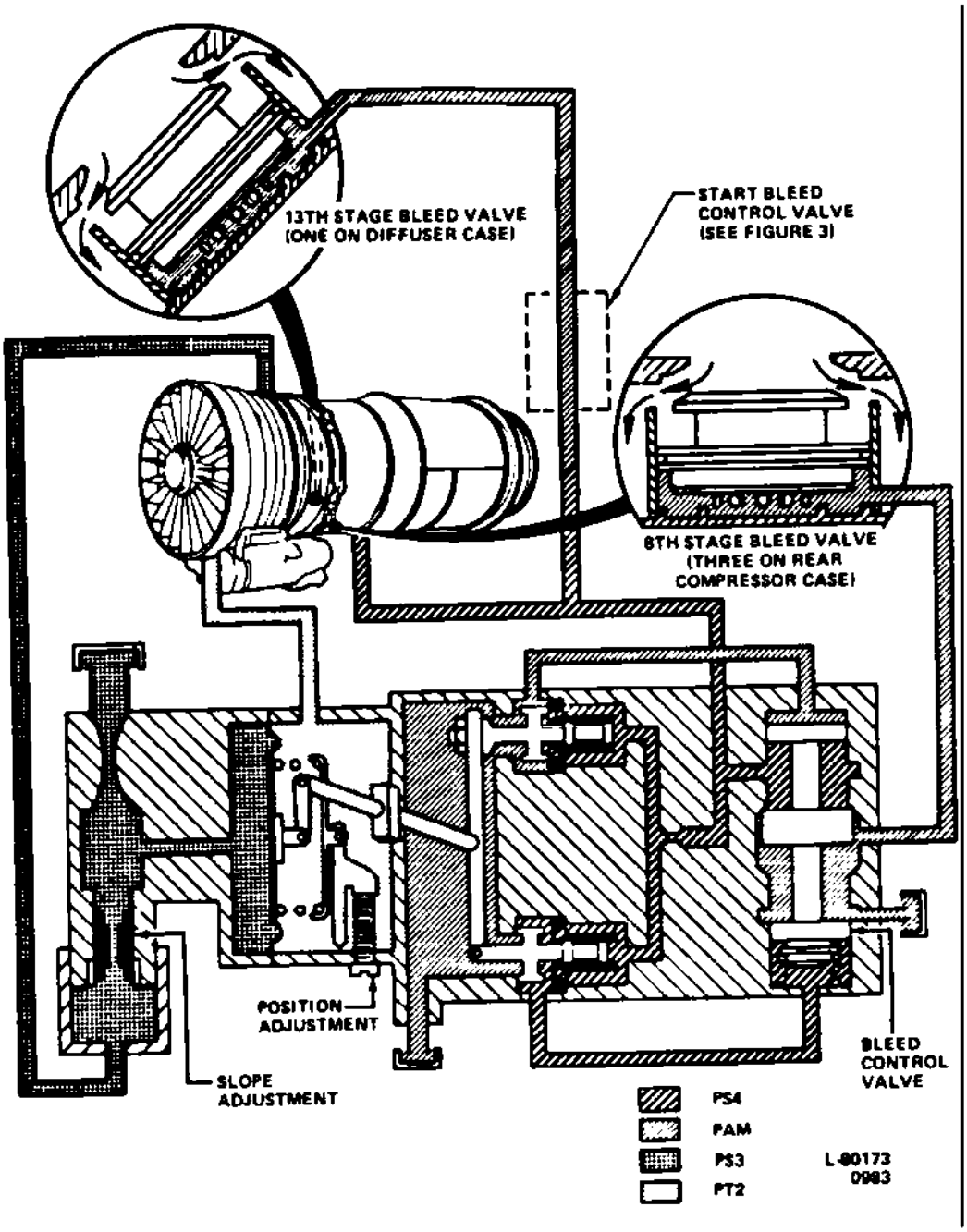
Bleed System Schematic -
Closed (Prior To SB 5425)
Figure 1 (Sheet 1)
(Task 75-30-00-990-001)



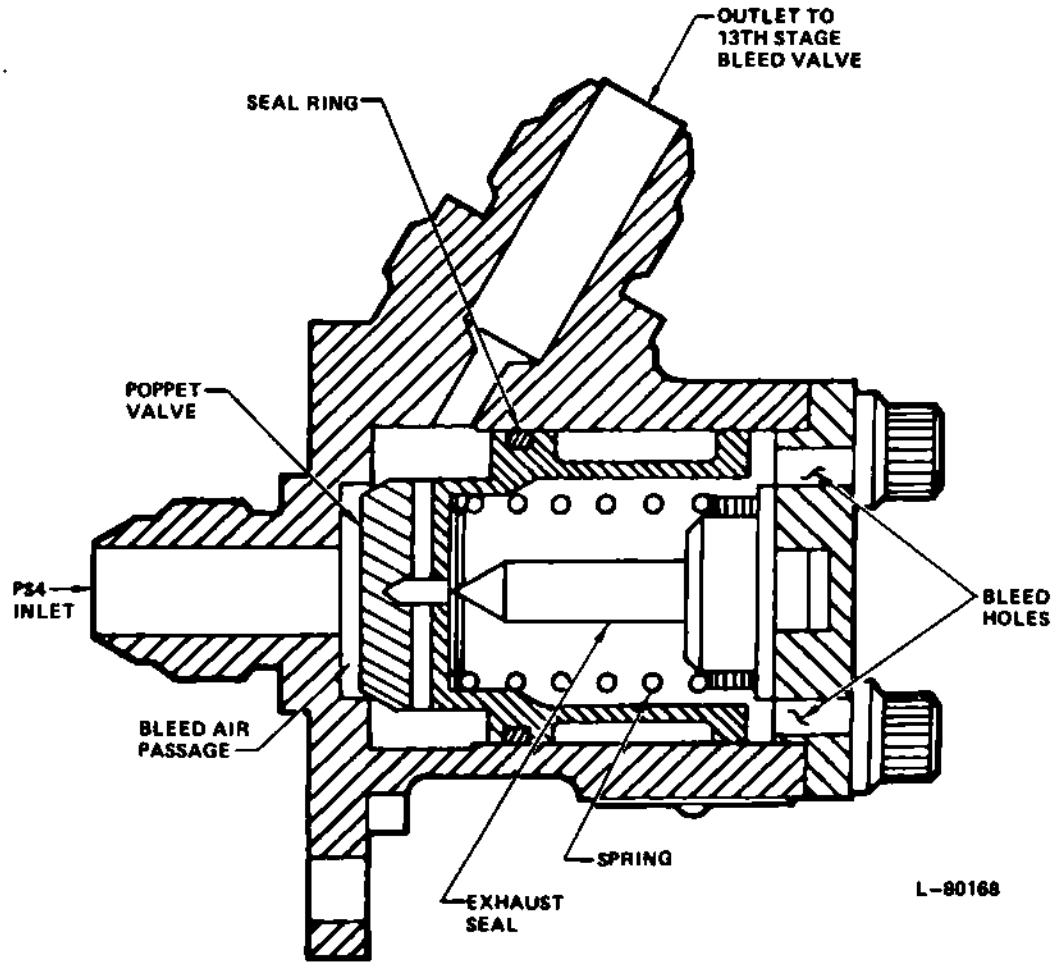
Bleed System Schematic -
Closed (Incorporating SB 5425)
Figure 1 (Sheet 2)
(Task 75-30-00-990-001)



Bleed System Schematic -
Open (Prior To SB 5425)
Figure 2 (Sheet 1)
(Task 75-30-00-990-001)



Bleed System Schematic -
Open (Incorporating SB 5425)
Figure 2 (Sheet 2)
(Task 75-30-00-990-001)



Start Bleed Control Valve
(Engines Incorporating SB 5425)
Figure 3
(Task 75-30-00-990-001)

Task 75-30-00-210-001:

1. Periodic Inspection

A. General

(1) These inspection procedures are a normal function of operating organizations. They consist of required inspections and minor adjustments necessary on the JT8D engine. The nature and conditions of engine operation determine the time interval between required inspections. For this reason, the intervals described in the Periodic Inspection Chart in this section are labeled Routine, Minor, and Major.

(2) Engine compartment cleanliness is important because the extensive mass air flow tends to draw foreign objects into the engine. Thoroughly clean the entire engine compartment with a vacuum cleaner after completion of any work. Keep the compartment free of dirt, oil and grease, and remove all unused parts, such as nuts, washers, and pieces of lockwire. Immediately cover all apertures resulting from the disconnection of tubing or parts. Use external caps on all tube openings, not internal plugs.

(3) Carefully inspect the compressor bleed system without dismantling to ensure that all connections are tight and free from leaks and that lines, tubing, and controls are secure.

B. Periodic Inspection Chart

COMPRESSOR BLEED SYSTEM

Component	Nature of Inspection	Inspection Time Routine	Minor	Major	Remarks
Pressure Ratio Bleed Control	a. Security of mounting.		X	X	
	b. Security of accessible lines and fittings.		X	X	

COMPRESSOR BLEED SYSTEM

Component	Nature of Inspection	Inspection Time Routine	Minor	Major	Remarks
Pressure Ratio Bleed Control Ps3 Pressure Air Supply Strainer, PN 440506, (Located in Fitting on Front of High Pressure Bleed Pad at 11 O'clock Position)	a. Foreign matter; strainer damaged			X	Replace strainer, or if service-able, clean with a standard solvent then dry with compressed air.
Pressure Ratio Bleed Control Ps3 Air Supply Screen (In Control Inlet)	a. Foreign matter.			X	Disconnct Ps3 line from pressure bleed control and remove fitting metering plug, venturi, and screen. Brush clean parts and re-assemble.
Compressor Bleed Valve, 8th or 13th Stage	a. Make sure the bleed valves move freely.			X	Bleed valves that do not operate freely can be lubricated by the following procedure.

COMPRESSOR BLEED SYSTEM

Component	Nature of Inspection	Inspection Time Routine	Minor	Major	Remarks

(CONTINUED)

NOTE: Bleed valves that cannot be freed by lubrication and bleed valves that need frequent lubrication should be removed and overhauled as given in CMM 75-32-01.

(1) Disconnect the PS4 tube (muscle line) at the connection nearest to the bleed valve that will get
R the lubricant. See Figure 601.

(2) Inject 4 - 6 ounces (120 - 175 ml) of approved lubricant into the disconnected end of the Ps4 tube.

(3) Apply 100 psig (689.5 kPa) of air or nitrogen to make sure that there is flow into the valve (this will also make the valve move).

(4) Let the lubricant stay in the valve for 30 minutes.

(5) Connect the Ps4 tube (muscle line) again.

(6) Cause the valve to operate (open and close) by one of these methods:

(a) Apply alternately pressure and suction to the Ps4 tube (muscle line) to open and close the valve two or three times. Listen for the sound of the valve as it moves into position. If the bleed valve continues to not move, go on to step (b).

(b) Start the engine and accelerate up to the bleed-close point two or three times to make the valve open and close.

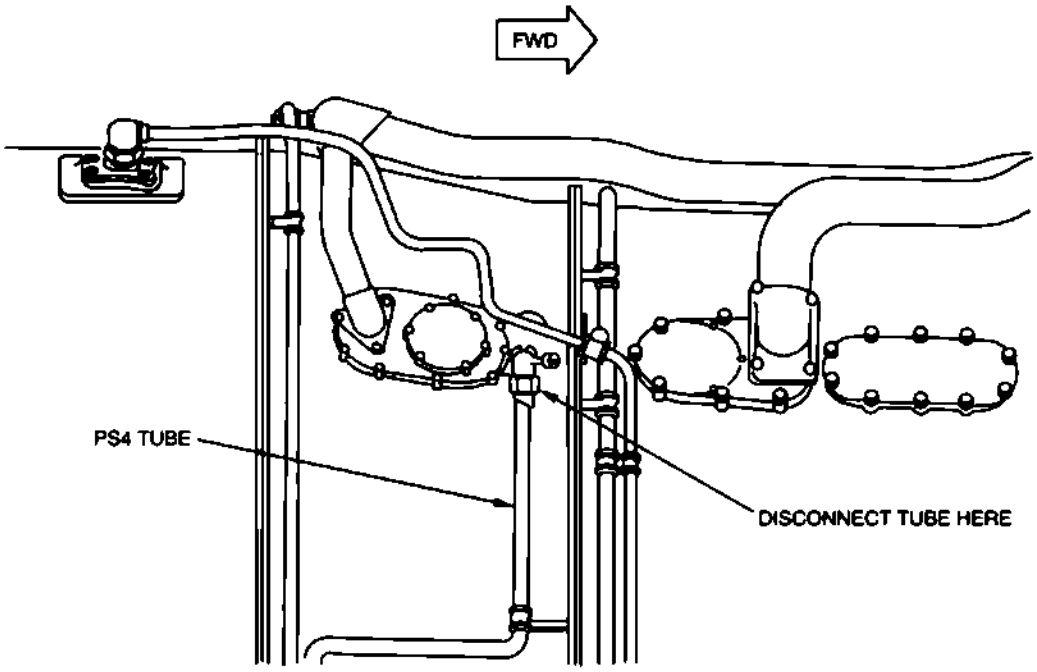
NOTE: The only lubricant approved for this application is WC-393. This is the only product known to PW which keeps its lubricating properties at engine operating temperatures without gumming or coking (which can result in increased seizing of the valve).

NOTE: WC-393 lubricant can be obtained from the source that follows:

(CONTINUED)

Aviation Fluids Services, Inc.
950 Kingsland Ave.
St. Louis, MO 63130

Phone: (800) 325-4720 or (314) 721-2910



UPPER RIGHT SIDE OF ENGINE

L-H7872 (0506)
PW V

Ps4 Tube Connection
Figure 601
(Task 75-30-00-210-001)

PRESSURE RATIO BLEED CONTROL - DESCRIPTION-00

Task 75-31-01-990-001:

1. Description and Operation of Pressure Ratio Bleed Control

A. Description and Operation

(1) The pressure ratio bleed control is located on the lower right side of the engine at the diffuser section.

(2) Compressor discharge air (Ps4) is routed to the pressure ratio bleed control mounted on the outside of the engine. This unit operates so as to schedule the bleed valve operation as a function of the pressure rise across the front compressor. Senses utilized are inlet total pressure (Pt2) and compressor discharge static pressure (Ps3).

(3) Ps3 is ported through a two-stage nozzle system and the resultant sense, upstream of the second nozzle moves a diaphragm against Pt2 and spring pressure. Any change from the schedule position of the diaphragm produces a corrective action by varying the low pressure bleed valves. This is accomplished by a yoke which transmits the signal from the diaphragm to a transfer valve assembly consisting of poppet valves linked together. Movement of these valves directs high compressor discharge air (Ps4) to a "servo valve" which in turn moves to port actuating air to the manifold which supplies the individual bleed valves. On current engines (reference SB 5425) the pressure ratio bleed control directs actuating air to three 8th stage bleed valves; a remaining 13th stage bleed valve is not controlled by the pressure ratio bleed control but is controlled by a start bleed control valve (see Chapter/Section 75-31-31, Description And Operation). On engines before SB 5425 the pressure ratio bleed control directs actuating air to the 8th stage bleed valve (if present) and two 13th stage bleed valves. See Chapter/Section 75-30-00, Description And Operation.

PRESSURE RATIO BLEED CONTROL - REMOVAL/INSTALLATION-00

Task 75-31-01-450-001:

1. Removal/Installation of the Pressure Ratio Bleed Control Tubes

A. Removal

(1) Remove the pressure ratio bleed control tubes that follow from the engine:

(a) Before SB 5425:

1 Bleed control high pressure air supply tube (Ps4).

2 Bleed control high pressure air sensing tube (Ps4).

3 Bleed control low pressure air supply tube (Ps3).

4 Bleed control low pressure air sensing tube (Pt2).

(b) Incorporating SB 5425:

1 Bleed control Ps4 manifold.

2 Bleed control high pressure air sensing tube (Ps4).

3 Bleed control low pressure air supply tube (Ps3).

4 Bleed control low pressure air sensing tube (Pt2).

5 Bleed control Ps4 tube (to start bleed control valve).

B. Installation
See Figures 401 through 403.

(1) Use new packings and/or retainers as indicated and install the pressure ratio bleed control tubes that follow:

(a) Before SB 5425:

1 Bleed control high pressure air supply tube which connects at the top of the engine to the de-icing manifold and to the bleed control.

2 Bleed control high pressure air sensing tube which connects at the pad (2 o'clock position) on the diffuser outer duct and to the bleed control.

3 Bleed control low pressure air supply tube which connects to the bleed control with two new packings and two retainers. Connect the other end of the tube to the strainer housing (at the 10 o'clock position) on the diffuser outer duct.

4 Bleed control low pressure air sensing tube with two new packings and two retainers. Connect the other end of the tube to the compressor inlet case (5 o'clock position.

5 Tighten nuts to the recommended torque and lockwire.

6 Install clips and brackets on the tubes.

(b) Incorporating SB 5425:

1 Bleed control Ps4 manifold, between the de-icing air manifold and bleed control. Connect the Ps4 tube leading to start bleed control valve to manifold.

2 Bleed control high pressure air sensing tube between the diffuser outer duct pad (2 o'clock position) and the bleed control.

3 Bleed control low pressure air supply tube with two new packings and retainers. Connect the other end of tube to the strainer housing (at the 10 o'clock position) on the diffuser outer duct.

4 Bleed control low pressure air sensing tube with two new packings and retainers. Connect the other end of the tube to the compressor inlet case (5 o'clock position).

Task 75-31-01-450-002:

2. Removal/Installation of the Pressure Ratio Bleed Control

A. Removal

(1) Disconnect the pressure ratio bleed control tubes at the control (see Paragraph 1.)

(2) Unfasten the bolts (formerly locknuts) and remove the pressure ratio bleed control from the lower right side of the engine.

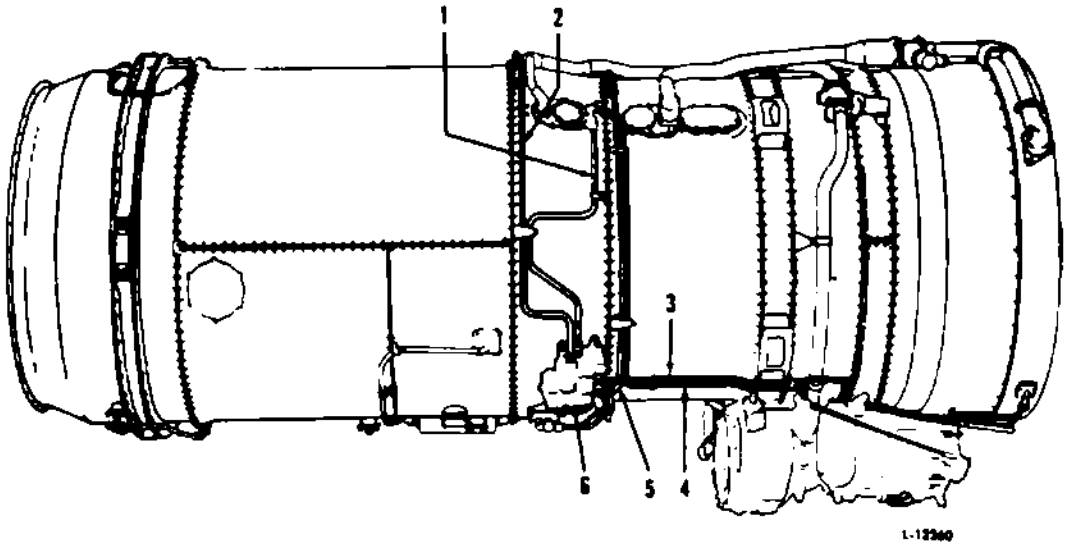
B. Installation

(1) Put the pressure ratio bleed control on the diffuser outer duct (5 o'clock position).

(2) Attach the assembly with four washers and bolts. Torque the bolts.

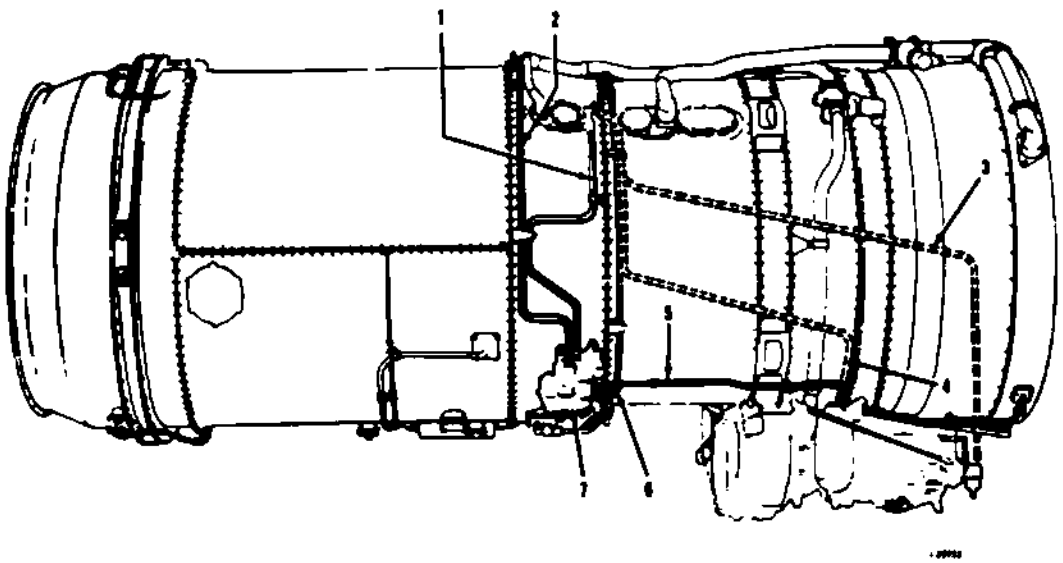
NOTE: Use washers and locknuts for stud type installations.

(3) Connect the bleed control tubing and secure (see Paragraph 1).



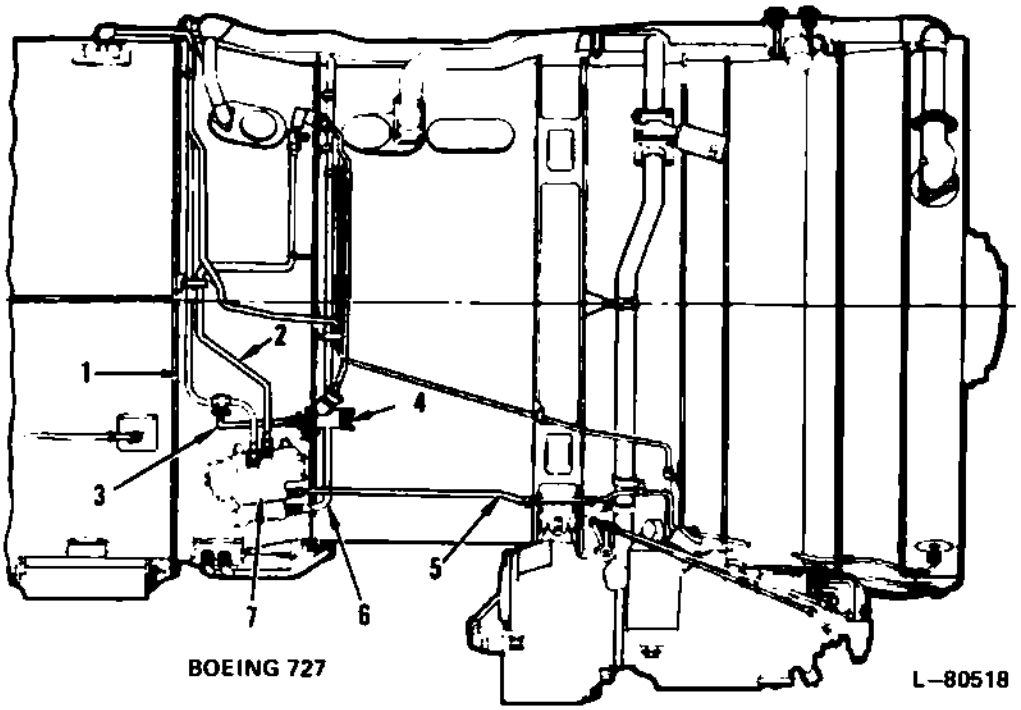
1. Bleed Control High Pressure Air Sensing Tube
2. Bleed Control High Pressure Air Supply Tube
3. Bleed Control Low Pressure Air Sensing Tube
4. Fuel Control Rear Ps4 Tube
5. Bleed Control Low Pressure Air Supply Tube (Ps3)
6. Pressure Ratio Bleed Control

Pressure Ratio Bleed Control
And Tubing (Early Engines)
Figure 401
(Task 75-31-01-450-002)



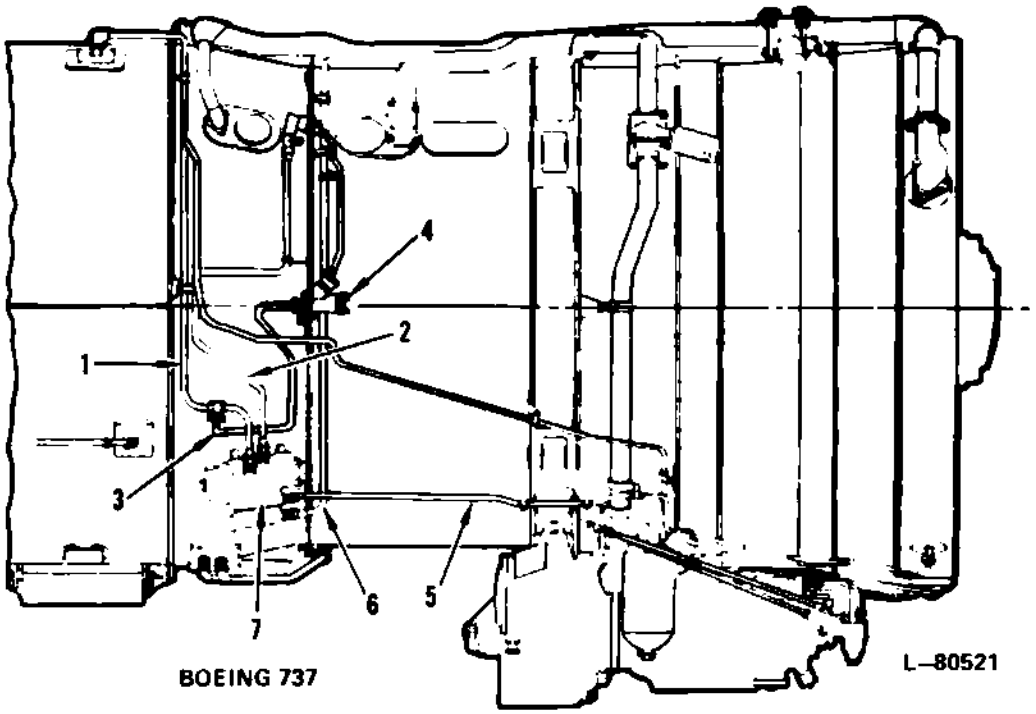
1. Bleed Control High Pressure Air Sensing Tube
2. Bleed Control High Pressure Air Supply Tube
3. Fuel Control Rear Ps4 Tube (Douglas)
4. Fuel Control Rear Ps4 Tube (Boeing)
5. Bleed Control Low Pressure Air Sensing Tube (Pt2)
6. Bleed Control Low Pressure Air Supply Tube (Ps3)
7. Pressure Ratio Bleed Control

Pressure Ratio Bleed Control
And Tubing (Before SB 5425)
Figure 402
(Task 75-31-01-450-002)



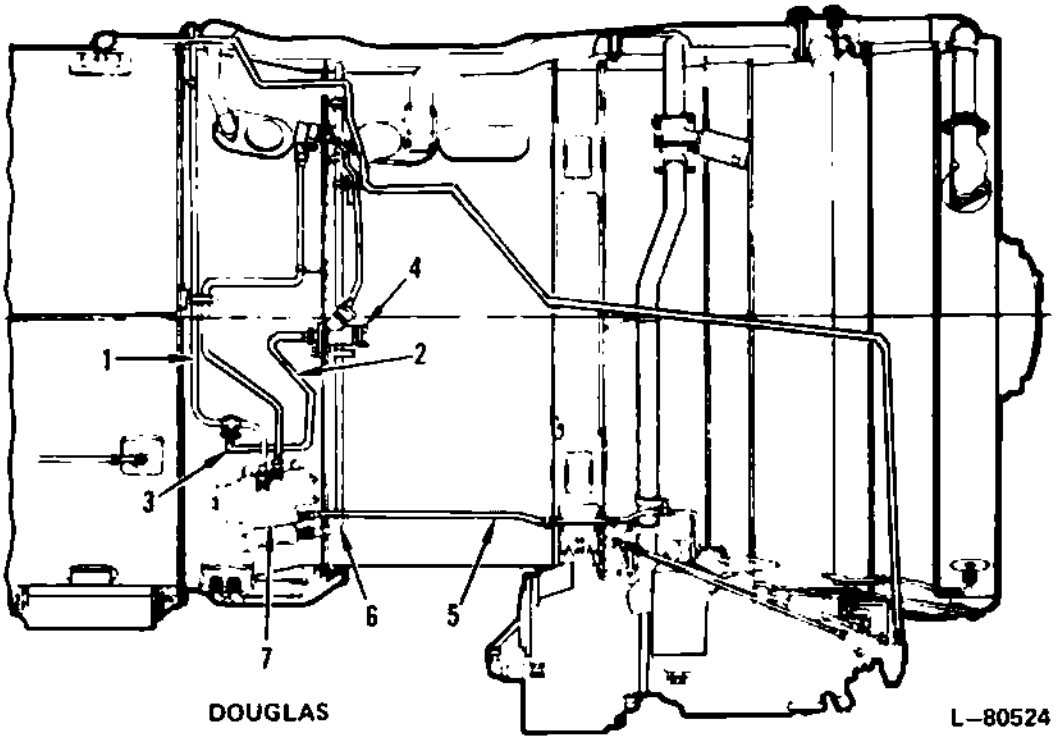
1. Bleed Control Ps4 Manifold
2. Bleed Control High Pressure Air Sensing Tube
3. Bleed Control Ps4 Tube
4. Start Bleed Control Valve
5. Bleed Control Pt2 Tube
6. Bleed Control Ps3 Tube
7. Pressure Ratio Bleed Control

Pressure Ratio Bleed Control And
Tubing (Incorporating SB 5425)
Figure 403 (Sheet 1)
(Task 75-31-01-450-002)



1. Bleed Control Ps4 Manifold
2. Bleed Control High Pressure Air Sensing Tube
3. Bleed Control Ps4 Tube
4. Start Bleed Control Valve
5. Bleed Control Pt2 Tube
6. Bleed Control Ps3 Tube
7. Pressure Ratio Bleed Control

Pressure Ratio Bleed Control And
Tubing (Incorporating SB 5425)
Figure 403 (Sheet 2)
(Task 75-31-01-450-002)



1. Bleed Control Ps4 Manifold
2. Bleed Control High Pressure Air Sensing Tube
3. Bleed Control Ps4 Tube
4. Start Bleed Control Valve
5. Bleed Control Pt2 Tube
6. Bleed Control Ps3 Tube
7. Pressure Ratio Bleed Control

Pressure Ratio Bleed Control And
Tubing (Incorporating SB 5425)
Figure 403 (Sheet 3)
(Task 75-31-01-450-002)

START BLEED CONTROL VALVE - DESCRIPTION-00

Task 75-31-31-990-001:

1. Description And Operation Of Start Bleed Control Valve (SB 5425)

   A. Description And Operation Of Start Bleed Control Valve (SB 5425)

      (1) The start bleed control valve is located on the right side of the engine at Flange H. This valve is designed to keep 13th stage bleed valve actuating air from reaching the valve during the starting cycle. When Ps4 actuating pressure reaches a high enough level, it overcomes the internal valve spring pressure and closes the single 13th stage bleed valve. When Ps4 decreases below the point at which it overcomes the valve spring pressure, the start valve closes, cutting off actuating air to the bleed valve. Pressure in the upper bleed control tube is vented to the outside through bleed passages in the poppet valve and bleed holes in the valve housing, and the 13th stage bleed valve is allowed to open.

START BLEED CONTROL VALVE - REMOVAL/INSTALLATION-00

Task 75-31-31-450-001:

1. Removal/Installation Of Start Bleed Control Valve (Engine Incorporating SB 5425)

See Figure 401.

A. Removal

(1) Remove the bleed control Ps4 tube from between the start bleed control valve and bleed control Ps4 manifold.

(2) Remove the bleed control Ps4 tube from between the start bleed control valve and the diffuser outer duct boss.

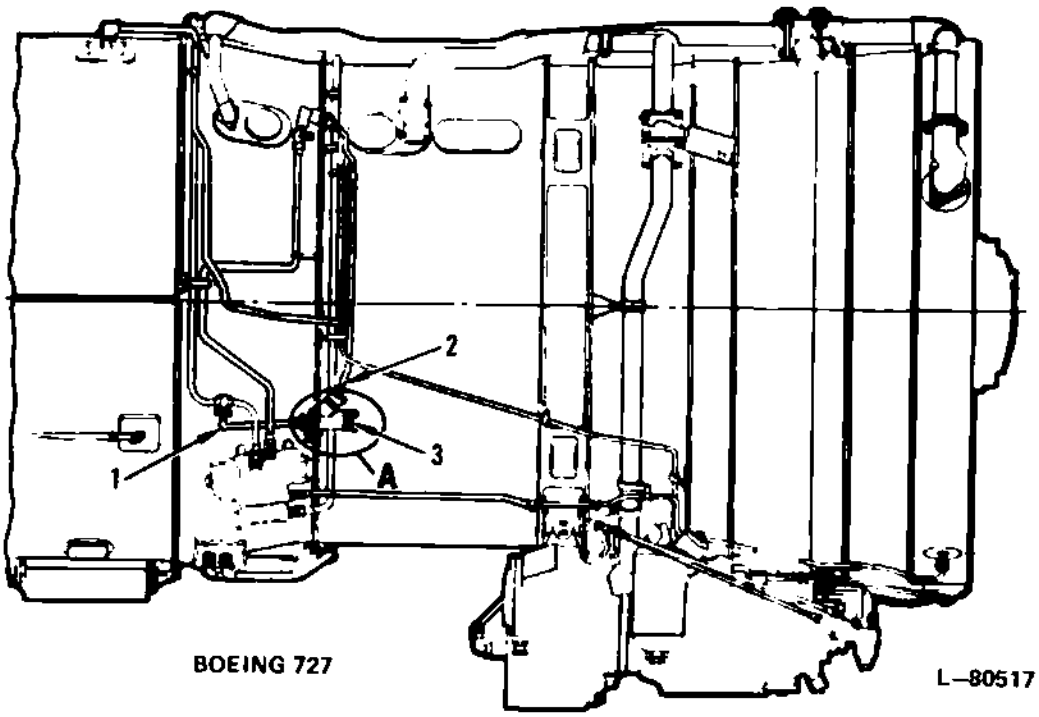
(3) Remove the bolt and the start bleed control valve from the flange bracket.

B. Installation

(1) Install the start bleed control valve with the bolts on the bracket at Flange H, angled fitting facing forward.

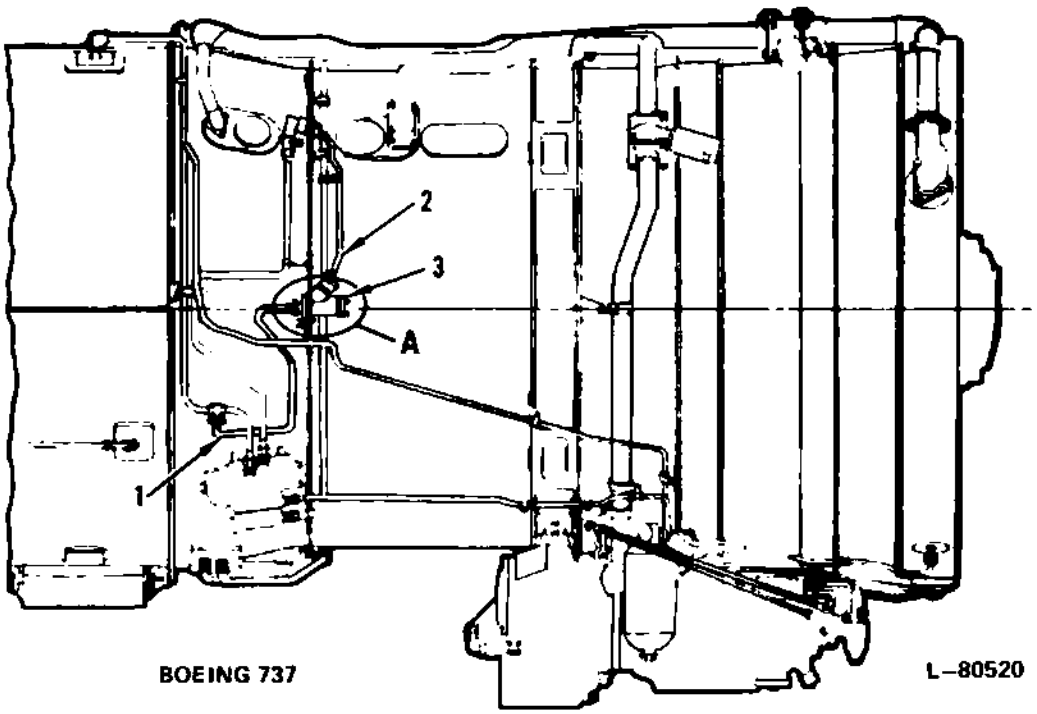
(2) Install the bleed control Ps4 tube between the start bleed control valve and the diffuser outer duct boss.

(3) Install the bleed control Ps4 tube between the start bleed control valve and the bleed control Ps4 manifold.



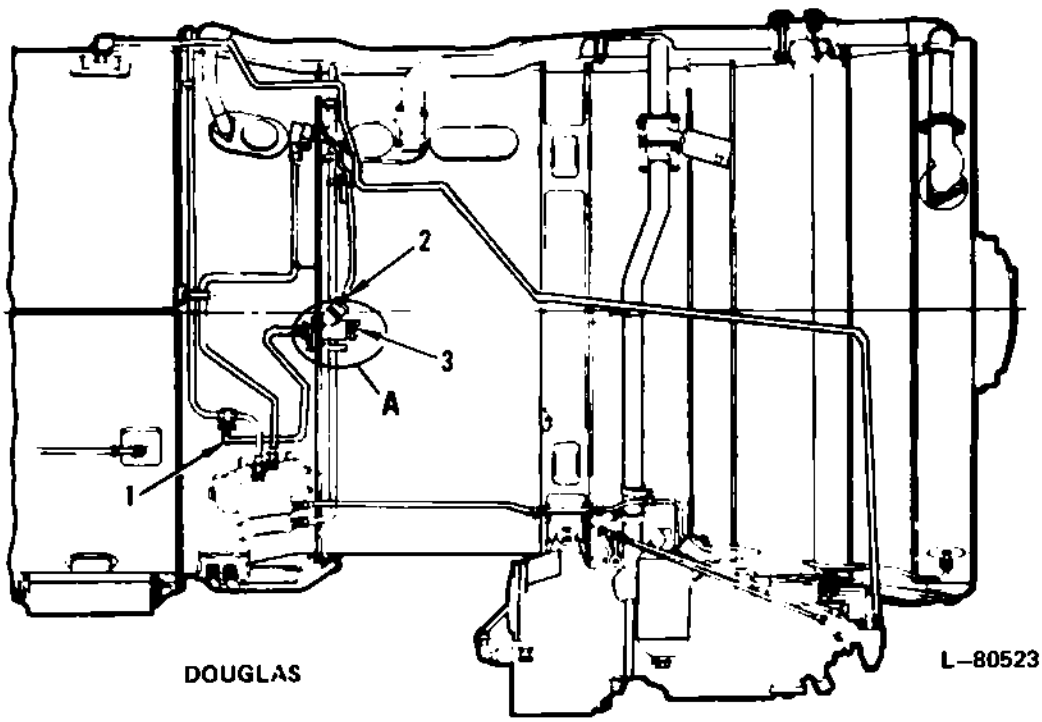
1. Bleed Control Ps4 Tube (Lower)
2. Bleed Control Ps4 Tube (Upper)
3. Start Bleed Control Valve

Start Bleed Control Valve
Removal/Installation
Figure 401 (Sheet 1)
(Task 75-31-31-450-001)



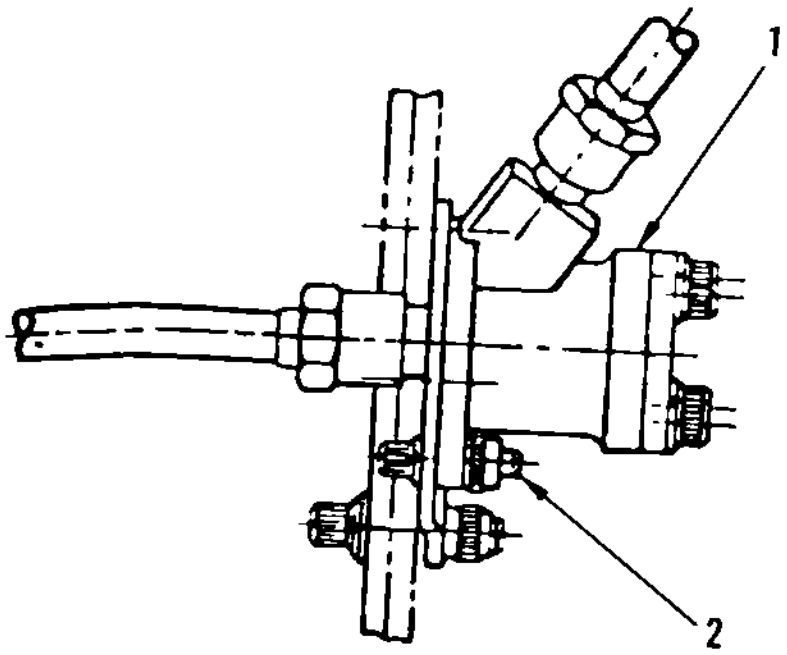
1. Bleed Control Ps4 Tube (Lower)
2. Bleed Control Ps4 Tube (Upper)
3. Start Bleed Control Valve

Start Bleed Control Valve
Removal/Installation
Figure 401 (Sheet 2)
(Task 75-31-31-450-001)



1. Bleed Control Ps4 Tube (Lower)
2. Bleed Control Ps4 Tube (Upper)
3. Start Bleed Control Valve

Start Bleed Control Valve
Removal/Installation
Figure 401 (Sheet 3)
(Task 75-31-31-450-001)



VIEW A

L-80525

1. Start Bleed Control Valve
2. Bolt And Nut (Three Required)

Start Bleed Control Valve
Removal/Installation
Figure 401 (Sheet 4)
(Task 75-31-31-450-001)

77-00-00

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77–11–01	TURBINE EXHAUST PRESSURE PROBES – MAINTENANCE PRACTICES–00 • 77–11–01–110–001: Cleaning Turbine Exhaust Pressure Probes in Engine • 77–11–01–720–001: Air Pressure Check
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77–21–01	THERMOCOUPLES – DESCRIPTION–00 • 77–21–01–990–001: Description and Operation of Thermocouples
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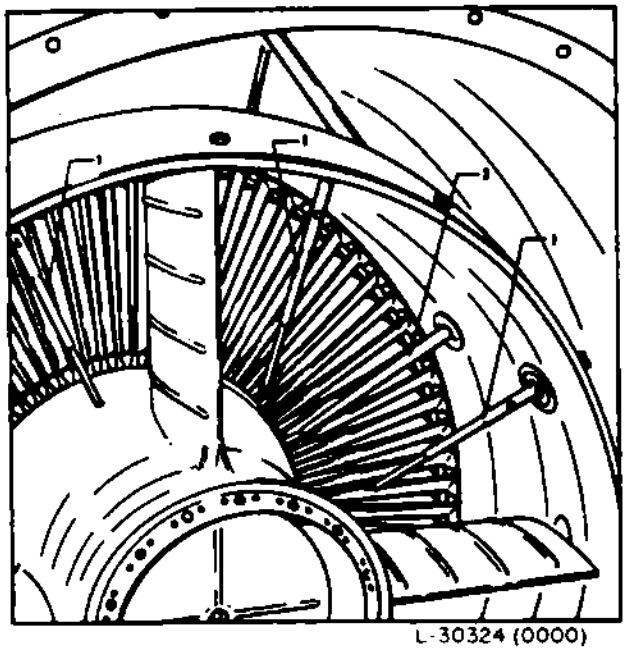
ENGINE INDICATING SYSTEM - DESCRIPTION-00

Task 77-00-00-990-001:

1. Engine Indicating - Description and Operation

See Figure 1.

A. The two engine indicating systems furnished with the JT8D engine are the turbine exhaust temperature indicating system and the turbine exhaust total pressure indicating system. The temperature indicating system consists of eight, single junction thermocouple probes connected by a branched cable to provide individual thermocouple temperature indications. A special purpose lead connected to the branch cable provides an average EGT (Tt7) indication at the lug type terminal block. The pressure indicating system consists of six pressure sensing probes connected by tubes to measure the average pressure in the turbine discharge area (Pt7).



1. Thermocouple Probe (Tt7)
2. Pressure Probe (Pt7)

Pressure and Temperature Probes
Figure 1
(Task 77-00-00-990-001)

Pratt & Whitney
JT8D MAINTENANCE MANUAL (PN 481671)

Please insert the revised pages into this manual and delete obsoleted pages in accordance with the following List of Effective Pages. Revised pages are indicated by the letter "R", added pages by the letter "A", and deleted pages by the letter "D". Superseded pages shall be removed and destroyed.

The List of Effective Pages records not only each page of subject revision but also each previously issued page which is still current. Blank pages and pages which are no longer current do not appear on this list. If there is any question about the currency of the maintained copy, it is recommended that each page of the manual be checked off against this List of Effective Pages. Any page which does not check out with this list, either by number or by date, shall be discarded. This list is reissued in its entirety whenever this manual section is revised.

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TO: RECIPIENTS OF JT8D MAINTENANCE MANUAL, PART NUMBER 481671

REVISION NO. 136 DATED OCTOBER 15, 2008

HIGHLIGHTS - 77 - ENGINE INDICATING

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77-11-01 MNT PRAC-00	202	Replaced PWA 21875 Regulator with PWA 45363. (TB21875B1)	-ALL

77 - ENGINE INDICATING

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TURBINE EXHAUST PRESSURE INDICATING SYSTEM - DESCRIPTION-00

Task 77-10-00-990-001:

1. Description and Operation of the Turbine Exhaust Pressure Indicating System

   A. Six averaging total pressure probes, manifold together forward of the mount ring on the turbine exhaust outer case, measure the turbine outlet total pressure. In using these pressure probes, connection is made to the manifold at a single external point (bottom left of the turbine exhaust outer duct) to measure the average pressure at the turbine discharge (Pt7).

   B. The probes are located at the approximate two, four, seven, eight, ten, and twelve o'clock positions.

TURBINE EXHAUST PRESSURE INDICATING SYSTEM - INSPECTION/CHECK-00

Task 77-10-00-210-001:

1. Periodic Inspection

A. General

(1) These inspection procedures are a normal function of operating organizations. They consist of required inspections and minor adjustments necessary on the JT8D engine. The nature and conditions of engine operation determine the time interval between required inspections. For this reason, the intervals described in the Periodic Inspection Chart in this section are labeled Routine, Minor, and Major.

(2) Engine compartment cleanliness is important because the extensive mass air flow tends to draw foreign objects into the engine. Thoroughly clean the entire engine compartment with a vacuum cleaner after completion of any work. Keep the compartment and the annular duct free of dirt, oil and grease, and remove all unused parts, such as nuts, washers, and pieces of lockwire. Immediately cover all apertures resulting from the disconnection of tubing or parts. Use external caps on all tube openings, not internal plugs.

(3) Carefully inspect the turbine exhaust pressure indicating system without dismantling to ensure that all connections are tight and free from leaks and that lines, and tubing are secure. See Chapter/Section 77-11-01, Maintenance Practices-00, for the air pressure check.

NOTE: If one of the Pt7 manifold tubes has a crack or a leak, you can disconnect and remove that tube. The Pt7 probe fitting (on both ends of the removed manifold tube) must be sealed off with a stainless steel cap and safety wired. This procedure is limited to one Pt7 manifold tube and must be used for temporary engine operation only. Test the engine and do a check for the correct EPR limits. Replace the defective Pt7 manifold tube with a new or repaired tube as soon as possible.

B. Periodic Inspection Chart

TURBINE EXHAUST PRESSURE INDICATING SYSTEM

Component	Nature of Inspection	Inspection Time Routine	Minor	Major	Remarks
Turbine Discharge Pressure Probe	a. Burned or broken probe.	X	X	X	
	b. Security of probe and attached line.		X	X	

Task 77-11-01-110-001:

1. Cleaning Turbine Exhaust Pressure Probes in Engine

NOTE: If low EPR is experienced and is not corrected by routine methods, check probes for cleanliness.

A. Cleaning Procedure (Method 1 - Solvent)

(1) Disconnect line to exhaust pressure manifold on turbine exhaust outer rear duct.

(2) Attach a line to pressure manifold and pressure flush manifold and probes 10 - 30 minutes with PMC 9001 or PMC 9010 solvent. Watch spray pattern for evidence of blocked probes.

NOTE: Blocked probe (or probes) will be noted usually during the first ten minutes of pressure flush.

(3) If probe(s) remain plugged, continue to flush until probe(s) are clean.

(4) Disconnect pressure flush line and drain all residual petroleum solvent. Air pressure dry manifold tubing and probes for approximately ten minutes.

CAUTION: ENSURE ALL RESIDUAL FLUID IN TURBINE AND EXHAUST AREA IS REMOVED BEFORE STARTING ENGINE.

(5) Reconnect airframe line to exhaust pressure manifold.

(6) Start the engine and do a Ground Idle run for five minutes (refer to Chapter/Section 72-00-00, Adjustment/Test-01, Task 72-00-00-760-006).

B. Cleaning Procedure (Method 2 - Hot Water)

(1) Disconnect the line to the exhaust pressure manifold on the turbine exhaust outer rear duct.

(2) Attach a line to the pressure manifold and pressure flush the manifold and probes with hot water at 122 - 160°F (50 - 71°C). Monitor the spray pattern for blocked probes (there are three or six holes in each probe as applicable).

R
R

(3) If a probe has holes that are fully blocked (either no water comes out of one or more holes, or there is only small leakage), remove the blockage with a hand-held 0.029 inch drill. Do not cause damage to a hole or make it larger.

(4) After all holes flow freely in all eight probes, stop the pressure flush procedure and drain all remaining water.

(5) Flow air through the cleaned probes to dry the manifold and probes for approximately ten minutes. Monitor all probe holes for air flow.

(6) Put 35 - 40 psig air in the pressure manifold (at the turbine exhaust outer duct). Use PMC 2277 or PMC 9569 leak check fluid to look for air leaks in manifold connections that were loosened. No leaks are permitted.

NOTE: Air will flow out through the probe holes during this pressure test. Keep air pressure up during the leak checks.

(7) Remove air pressure equipment and connect the airframe Pt7 sense line to the engine exhaust pressure manifold.

(8) Start the engine and do a Ground Idle run for five minutes (refer to Chapter/Section 72-00-00, Adjustment/Test-01, Task 72-00-00-760-006).

Task 77-11-01-720-001:

2. Air Pressure Check

A. Procedure

(1) Disconnect line to exhaust pressure manifold.

(2) Cap off all pressure sensing holes in all probes.

R (3) Connect PWA 45363 (formerly PWA 21875 or PWA 6814)
R Regulator Assembly to the pressure sensing probe
R manifold.

(4) Pressurize system 24 - 26 psig and close off.

(5) Leakage must not exceed 1/4 psig per five minute period.

NOTE: Use PMC 2277 or 9569 leak check fluid to find the location of leaks.

(6) Remove test tools after air check is completed.

(7) Reconnect airframe line to exhaust pressure manifold.

NOTE: See Chapter/Section 77-10-00, Inspection/Check-00, for engine operation procedure with one disconnected Pt7 manifold tube.

TURBINE EXHAUST TEMPERATURE INDICATING SYSTEM - DESCRIPTION-00

Task 77-20-00-990-001:

1. Description and Operation of The Turbine Exhaust Temperature Indicating System

   A. The averaging temperature measurement provided by this system is an operating limit on the engine and is used to monitor the mechanical integrity of the turbines as well as to check engine condition during operation. The system utilizes eight thermocouple probes whose temperature outputs are averaged by a thermocouple cable assembly. The averaged exhaust gas temperature (EGT) is transmitted from the thermocouple cable assembly to the airframe interface by a thermocouple lead.

   B. Engines incorporating an EGT boostcircuit utilize a thermocouple lead featuring circuitry that artificially raises the EGT readout by 50°F (28°C) to an indicated EGT of 1274°F (690°C). A proportionately lesser quantity of boost will occur at a lower indicated temperature. This is accomplished by isolating the output of two selected thermocouple probes, reducing the averaged output of these two probes to the desired value of the boost signal, and adding this boost signal to the averaged EGT output of the remaining six thermocouple probes. The result is a boosted EGT reading for cockpit use. The thermocouple lead associated with this boost circuit contains an integral fixed resistor to reduce the boost signal to its desired value.

   C. The eight thermocouple probes are mounted on the turbine inner rear case and extend into the turbine discharge passage.

Task 77-20-00-210-001:

1. Periodic Inspection

A. General

(1) These inspection procedures are a normal function of operating organizations. They consist of required inspections and minor adjustments necessary on the JT8D engine. The nature and conditions of engine operation determine the time interval between required inspections. For this reason, the intervals described in the Periodic Inspection Chart in this section are labeled Routine, Minor, and Major.

(2) Engine compartment cleanliness is important because the extensive mass air flow tends to draw foreign objects into the engine. Thoroughly clean the entire engine compartment with a vacuum cleaner after completion of any work. Keep the compartment and the annular duct free of dirt, oil and grease, and remove all unused parts, such as nuts, washers, and pieces of lockwire. Immediately cover all apertures resulting from the disconnection of parts. Use external caps on all openings, not internal plugs.

(3) Carefully inspect the turbine exhaust temperature indicating system without dismantling to ensure that all connections are tight and that lines are secure.

B. Periodic Inspection Chart

TURBINE EXHAUST TEMPERATURE INDICATING SYSTEM

Component	Nature of Inspection	Inspection Time Routine	Minor	Major	Remarks
Thermocouples and Cable	a. Burned, broken, deformed probes.	X	X	X	NOTE: Routine and minor inspection
	b. Chafed or broken wiring.		X	X	requirements refer only to parts of
	c. Continuity and insulation resistance of cable.			X	the harness that are visible without removal of

TURBINE EXHAUST TEMPERATURE INDICATING SYSTEM

Component	Nature of Inspection	Inspection Time Routine	Minor	Major	Remarks
(CONTINUED)					
	d. Proper calibration of Tt7 system.			X	ducting or fairing.

Task 77-20-00-750-001:

2. Required Electrical Check Of EGT System To Be Performed On Engines Incorporating Boost Circuit During Every Basic Hot Section Inspection.

See Figure 601.

A. Short Circuit Check

(1) Disconnect terminals at locations A, B, C, D and E in Figure 601.

(2) Set ohmmeter range switch to a range which has center scale value of approximately ten ohms.

(3) Place one prod in good contact with well-cleaned alumel terminal A and other in good contact with well-cleaned chromel terminal B. Flex cable gently and observe instrument needle. If any deflection results (unless caused by accidental contact between other terminals of cable), reject part.

B. Continuity Check

(1) Set ohmmeter range switch to a range which has center scale value of approximately ten ohms.

NOTE: Broken wires which come into contact intermittently due to flexing will cause needle to fluctuate. False intermittent indications will result if ohmmeter prods are not in firm contact with clean terminals; also, if ohmmeter prods, leads, or jacks are defective fluctuations can occur.

(2) Perform continuity check for each of the following thermocouple lead circuits:

(a) A to C

(b) B to D*

(c) B to E

*Resistance of this circuit should be higher than that of other two because of integral fixed resistor.

NOTE: While you do a continuity check, gently flex the lead.

(d) Lead is unserviceable if high resistance (open circuit) is read on ohmmeter.

(3) Perform continuity check at the junction box for each of the following TT7 box and cable assembly circuits (with probes attached):

(a) 1 to J

(b) 6 to J

NOTE: While you do a continuity check, gently flex the cable assembly.

(c) TT7 box and cable assembly, TT7 probe No. 1 or TT7 probe No. 6, is unserviceable if high resistance (open circuit) is read on ohmmeter. Isolate the problem by Section 77-21-01 or 77-22-01 Inspection/Check-00.

(4) Connect the terminals at locations A, B, C, D and E.

(5) Do a continuity check from terminal A to B.

(6) If a high resistance (open circuit) is read on ohmmeter, system is unserviceable. If lead was serviceable per steps (2) through (4), isolate the discontinuity by testing the thermocouple cable assembly by Section 77-22-01, Inspection/Check-00.

C. Insulation Resistance Check
See Figure 601.

(1) Ensure that the thermocouple cable and leads are properly installed and connected.

NOTE: Insulation resistance values slightly below the limits set forth below may not result in a deficient EGT system. It does, however, clearly indicate that the insulation is deteriorating and will result in eventual shorts or erroneous EGT readings. Therefore, EGT system components with insulation resistance readings below the limits set forth require attention to restore the insulation resistance to acceptable values and prevent further deterioration and possible EGT system failure.

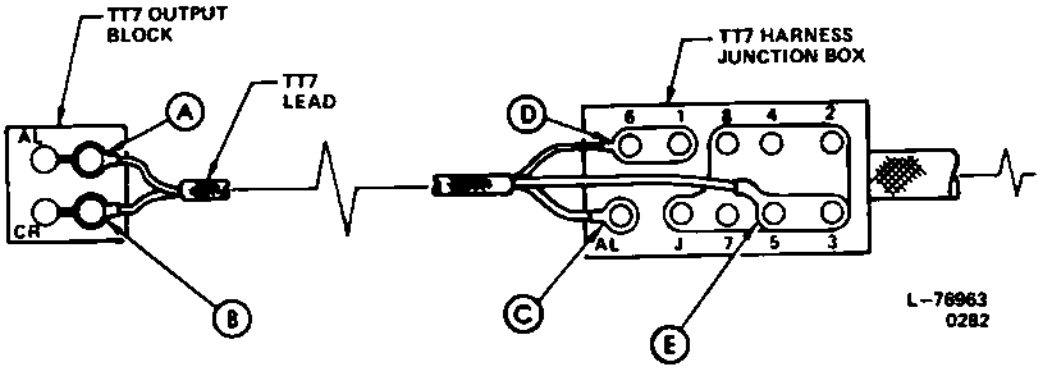
(2) Using low voltage ohmmeter, check insulation for short circuits, excessive leakage, and internal insulation chafing discrepancies. Check proper operation of instrument by touching test prods together and noting needle deflection to read zero ohms.

NOTE: Low voltage ohmmeter utilizing 50 volts (dc) or less and maintained at an accuracy of five percent shall be used for determining insulation resistance. Megger or other high voltage test shall not be used under any circumstances.

(3) Place one lead of ohmmeter in good contact with lug A. Place other lead in contact with wire braid.

(4) Read ohmmeter. Resistance reading should not be less than 50,000 ohms. If value below limit is recorded, presence of carbon or excessive moisture may be indicated. Carbon yields fairly steady reading. Moisture tends to produce readings which waiver or drift after five to 30 seconds. Presence of moisture may be corrected by baking affected part of EGT system at 200° - 250°F (93° - 121°C) for one hour and checking again.

NOTE: False drift may be due to variations in applied voltage. To check for false drift, place prods in contact with each other for ten seconds. Readings must not wander from full-scale deflection.



Exhaust Gas Temperature
System Boost Circuit
Figure 601
(Task 77-20-00-750-001)

THERMOCOUPLES - DESCRIPTION-00

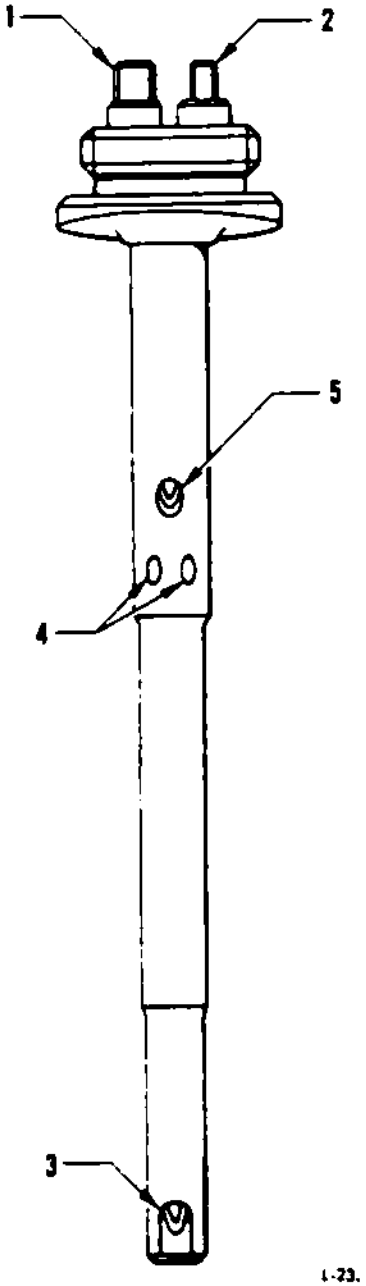
Task 77-21-01-990-001:

1. Description and Operation of Thermocouples

See Figure 1.

A. The thermocouple assembly consists of a probe and a head. Two thermocouple junctions are contained in the probe. These junctions are in parallel and electrically averaged in the head of the thernocouple assembly. They are located directly in the gas path in different positions within the probe. Two terminal studs are located at the head end of the thermocouple assembly. The larger diameter stud is alumel material and is connected to the alumel wires that make up one side of the thermocouple junctions. The smaller stud is chromel material and is connected to the chromel wires that make up one side of the thermocouple junctions. The voltage across the chromel and alumel studs is an average of the voltage induced at each of the junctions and is proportional to the average temperature of the two junctions.

B. The probe portion of the thermocouple assembly is located in the exhaust gas path. The assembly is fastened to the turbine exhaust case with a spannernut over the threaded thermocouple head. Proper orientation of the probe is assured by a key slot in the probe head. The thermocouple assembly is electrically connected to the wiring harness via harness terminal lugs fastened to the thermocouple assembly terminal studs. The functioning of a thermocouple circuit is primarily dependent upon a difference of materials at the thermocouple junctions and a difference in temperature between the hot junction and cold junction. The hot junction is located in the area to be measured, and the cold junction is generally located in the cockpit meter. One thermocouple material is alumel which if color coded is green, attracts a magnet and has a negative polarity. The other thermocouple material is chromel which if color coded is white, does not attract a magnet and has a positive polarity. With this difference in material and the temperature difference between the hot junction and the cold junction a voltage is induced in the circuit which is proportional to the temperature difference and deflects the cockpit meter.



1. Alumel Stud (Larger)
2. Chromel Stud (Smaller)
3. Outermost Sampling Port
4. Middle Sampling Ports
5. Innermost Sampling Port

Thermocouple
Figure 1
(Task 77-21-01-990-001)

Task 77-21-01-450-001:

1. Removal/Installation of Thermocouples

A. Removal

CAUTION: WHEN DISCONNECTING OR CONNECTING THERMOCOUPLE CABLE DO NOT BEND OR TWIST THERMOCOUPLE PROBE TERMINALS AS TERMINALS MAY LOOSEN IN SUPPORTING INSULATION AND INTERNAL WIRING MAY BREAK.

(1) Remove 12 screws retaining fan exhaust inner rear duct. Slide it to rear.

(2) Remove nuts holding cable leads to thermocouples. Remove alumel and chromel leads.

(3) Using PWA 33449 (formerly PWA 12437) Wrench, remove spannernut and then remove thermocouples by pushing them into turbine discharge passage and then out through rear.

B. Installation

(1) Install each thermocouple into turbine rear inner case aligning lug in case with slot in thermocouple.

CAUTION: TORQUE REQUIREMENTS FOR LOCKNUTS ON THERMOCOUPLE LEAD STUDS SHALL BE OBSERVED. OVER TORQUING OF LOCKNUTS CAN RESULT IN STUD LOOSENING OR BREAKAGE.

(2) Using PWA 33449 (formerly PWA 12437) Wrench, secure each thermocouple with nut. Tighten nut to torque indicated by Fits and Clearances Reference 1017, Chapter/Section 72-00-00, Inspection/Check-02. Attach alumel and chromel leads after lockwiring nut. Secure cable leads to thermocouples with locknuts. Tighten lead nuts. See Fits and Clearances References 1018 and 1019.

NOTE: For engines incorporating SB 1957, proper installation of Terminal Nuts (PN 558987 and 558988) requires that cylindrical grooved portion of nut must lead the way onto stud.

(3) Slide fan exhaust inner rear duct into position and secure with 12 screws and washers.

C. Thermocouple Tool List.

PWA 12437 Wrench
(Superseded by PWA 33449)
PWA 33449 Wrench
(Supersedes PWA 12437)

Task 77-21-01-210-001:

1. Visual Inspection

A. Procedure

(1) Inspect all surfaces of thermocouples for nicks, cracks, bending, or evidence of heat erosion.

(2) Check probe for straightness; allowable deformation of small OD (lower end) of probe is 1/8 inch.

(3) Minor nicks in shield are not cause for rejection. Cracks at any location render thermocouple unserviceable.

(4) Do not attempt to repair minor bends in shield.

(5) Check exhaust and inlet port openings for carbon buildup. If necessary, remove carbon with straight piece of steel wire.

(6) Check probe for looseness.

(7) Inspect terminal posts for looseness of thread damage. Deformation of 0.025 inch is allowable if posts are not loose and thermocouple is electrically sound. Straightening or repairing of bent posts is not permissible.

(8) On thermocouples, after abrasive blasting, inspect area for loss of stud insulation.

Task 77-21-01-210-002:

2. Electrical Check

NOTE: Before performing any of following tests, be sure that thermocouple has been satisfactorily cleaned according to instructions in Cleaning/Painting-00.

A. Thermocouple Integrity Check

(1) To check the thermocouple, place a soldering copper of at least 500 watts capacity in contact with one of the thermocouples. Observe the cockpit instrument for a deflection of the needle thereby proving continuity. Allow a sufficient period of time to elapse for the instrument needle to show a decrease in reading; then

repeat the process with successive thermocouples until all of them have been checked.

NOTE: This is not intended as a calibration check of the thermocouple. If the results of this check indicate a discontinuity in the averaging system, disconnect the thermocouple cable at the airframe connection and check the cable continuity as indicated in Chapter/Section 77-22-01, Thermocouple Cable, Inspection/Check-00. Application of heat during functional test, in many instances, causes wire to thermally change dimensions. If thermocouple circuit is cracked, circuit may become discontinuous and millivolt output will drop to zero. This condition cannot be readily detected by loop resistance and insulation checks at ambient temperature.

B. Continuity and Resistance Check

(1) Disconnect thermocouple cable from thermocouple.

(2) Using sensitive ohmmeter or Wheatstone's bridge, check continuity and resistance of thermocouple. Internal resistance of thermocouple must not exceed following limits:

Thermocouple Type	IC Number	Maximum Loop Resistance (Ohms)*
Slow Response	757019	0.120
Fast Response	698159	0.200

NOTE: Test leads must be securely attached to thermocouple studs. For most accurate reading, secure leads with thermocouple nuts.

(3) Using low voltage ohmmeter, check insulation resistance between both chromel and alumel terminals and body of thermocouple for minimum of 25 seconds for each measurement. Resistance must be at least 50,000 ohms. If resistance is within limits, thermocouples must be returned to service.

NOTE: Low voltage ohmmeter utilizing less than 40 volts (dc) and maintained at an accuracy of five percent must be used for determining insulation

resistance. A megger or other high voltage test must not be used under any circumstances.

(4) Connect cable leads to acceptable thermocouples.

C. Calibration Test (Optional)

(1) If thermocouple calibration is desired, heat soak probe to be tested, together with one of predetermined accuracy, in same oven and identical physical environment for at least one hour at 600°C (1112°F). A comparison between readings of test probe and standard may then be made.

(2) If a temperature controlled oven and pyropotentiometer are not available, replace suspect probe(s).

Task 77-21-01-120-001:

1. Cleaning of the Thermocouples

A. General

(1) Since operating temperatures to which turbine discharge indicating thermocouples are subjected are high, carbon deposits and dirt accumulation normally experienced at cooler locations will not present a cleaning problem. Do any minor cleaning operations which may be necessary, exercising caution to prevent mechanical damage.

NOTE: Carbon coating on thermocouple head reduces thermocouple resistance. Before checking resistance value, remove this coating, by using piston engine spark plug cleaning equipment containing AC Cleaning Compound, Type 2. Care shall be taken not to subject parts to excessive grit blasting.

B. Thermocouple Internal Cleaning
See Figure 701.

CAUTION: INSULATION MATERIAL USED WITHIN THERMOCOUPLE PROBE WILL READILY ABSORB LIQUIDS. SINCE OPERATION OF THERMOCOUPLE MAY BE ADVERSELY AFFECTED BY PRESENCE OF LIQUIDS IN INSULATION, IT IS IMPORTANT THAT LIQUID SOLVENTS NOT BE USED IN ANY WAY WHICH WOULD PERMIT THEIR ENTRY INTO THE SHIELD.

(1) Insert small nozzle into probe exhaust holes and remove carbon around thermocouple leads by air blasting.

(2) Direct air blast at approximately 100 psig through nozzle.

(3) Suggested nozzle may be fabricated from stainless steel tubing in accordance with dimensions shown in figure.

NOTE: Carbon removal will aid in increasing insulation resistance of thermocouple.

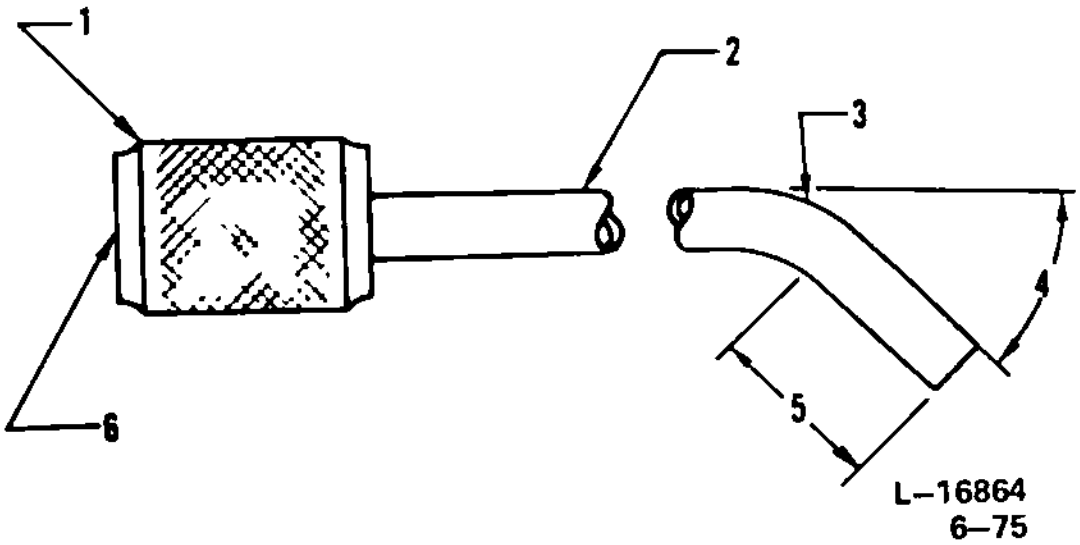
Task 77-21-01-120-002:

2. Grit Blasting

A. Procedure

CAUTION: SUBJECT THE THERMOCOUPLE TO BLASTING ONLY LONG ENOUGH TO REMOVE THE CARBON COATING FROM THE STUDS AND FROM THE AREA AROUND THEIR BASES.

(1) Carbon deposits which sometimes form on the head and terminal posts reduce thermocouple resistance. This coating may be removed by inserting the head only (not the probe) into a standard spark plug cleaning unit containing AC Cleaning Compound, Type 2.



1. Standard Connector
2. 0.040 Inch ID to 0.058 Inch OD Tube
3. 0.250
4. 45 Degrees
5. 0.200 Inch
6. 100 Psig Air Pressure Applied Here

Thermocouple Probe Cleaner
Figure 701
(Task 77-21-01-120-002)

THERMOCOUPLE LEAD AND CABLE - DESCRIPTION-00

Task 77-22-01-990-001:

1. Description and Operation of the Thermocouple Lead and Cable

   A. The thermocouple branched cable assembly consists of an electrical conduit mounted on the outer circumference of the turbine exhaust case. This cable assembly contains eight sets of branch leads which attach to the connections on the eight single junction thermocouples installed in the turbine exhaust case. This cable assembly is designed to provide individual readings of the eight thermocouples. The branched cable assembly is connected to a junction box which averages the individual thermocouple readings through the use of a bus bar. Individual thermocouple readings are obtained by removing this bus bar. A special purpose lead transmits the average reading at the junction box to an engine supplied, lug-type, terminal block.

THERMOCOUPLE LEAD AND CABLE - REMOVAL/INSTALLATION-00

Task 77-22-01-450-001:

1. Removal/Installation of Thermocouple Lead and Cable

A. Removal

CAUTION: WHEN DISCONNECTING OR CONNECTING THERMOCOUPLE CABLE, DO NOT BEND OR TWIST THERMOCOUPLE PROBE TERMINALS AS TERMINALS MAY LOOSEN IN SUPPORTING INSULATION AND INTERNAL WIRING MAY BREAK.

(1) Remove 12 screws securing upper and lower fan exhaust duct segments and slide rearward. For engines having one piece fan exhaust duct, remove 12 screws and slide duct to rear of engine. Remove duct(s) from engine.

CAUTION: WHEN REMOVING DUCT(S), DO NOT DAMAGE THERMOCOUPLES.

(2) Remove cable from alumel and chromel terminals on thermocouple probes.

(3) Remove 15 screws securing branched thermocouple cable to turbine exhaust case.

(4) Remove lead(s) from engine as follows:

(a) For engines incorporating SB 1647, remove (output) leads from junction box. See Inspection/Check-00 for applicable figures.

(b) For engines prior to SB 1647, unthread coupling nut and unplug lead connector from cable connector. See Inspection/Check-00 for applicable figures.

NOTE: Earlier configuration engines use screws, washers, and locknuts to secure both lead and cable connectors to engine bracket. Later engines (prior to SB 1647) use screws, etc., to secure only cable connector to engine bracket.

(c) Disconnect lead assembly front end from terminal board located at J flange and remove clamps (or sleeves and bolts, if so equipped). For SUD engines, remove screws and nuts securing (front) lead connector to bracket on top of engine. Remove lead assembly from engine.

CAUTION: IN ALL HANDLING AND STORAGE, CABLE (OR LEAD) SHOULD BE HUNG ON RACE OR LAID ON CLEAN TABLE FREE OF OIL AND MATERIAL WITH WHICH IT MAY BECOME ENTANGLED. SEVERE REPEATED FLEXING AND HARD BENDING OR TWISTING WILL BREAK OR FRAY EXPOSED INSULATION. IF HUNG ON RACK, CARE MUST BE TAKEN NOT TO PLACE ANY SMALL RADIUS BENDS IN ANY PART OF ASSEMBLY. IT IS DESIRABLE TO HANG CABLE ON RACK WHICH IS SIMILAR TO SEGMENT OF ROOT DIAMETER CIRCLE.

(5) Remove two bolts securing thermocouple cable fairing to fan exhaust outer duct.

(6) Remove bolts securing cable junction box (or cable connector) to bracket(s) on engine mount flanges. Remove thermocouple cable assembly through inside of engine.

B. Installation

(1) Install thermocouple cable assembly into rear ID of engine, junction box (or connector) through large opening at bottom of fan exhaust case. Place short harness to left (viewed from rear) and clip ends on harness up.

(2) Secure cable fairing to fan exhaust outer duct with bolts.

(3) Install 15 screws securing thermocouple cables to brackets in turbine exhaust case. Attach and secure cable ends to alumel and chromel terminals on thermocouple probes.

CAUTION: WHEN SECURING CABLE HARNESS TO EXHAUST CASE, POSITION CABLES BELOW CASE FLANGE DIAMETER SO AS NOT TO CONTACT INNER DUCT(S).

(4) Install upper and lower fan exhaust duct segments (fastened together) into turbine exhaust case. Slide segments forward and secure with 12 screws. For engines having one piece fan exhaust duct, slide duct forward and secure with 12 screws.

(5) Secure cable junction box (or connector) to bracket(s) on engine mount flanges.

(6) Install lead assembly on engine attaching end(s) of lead(s) to terminal board at J flange. For SUD engines, secure lead (front) connector to bracket at top of engine using screws and nuts. Secure middle position of lead assembly using clamps, bolts and sleeves, as applicable. Secure opposite (rear) end of lead assembly as follows.

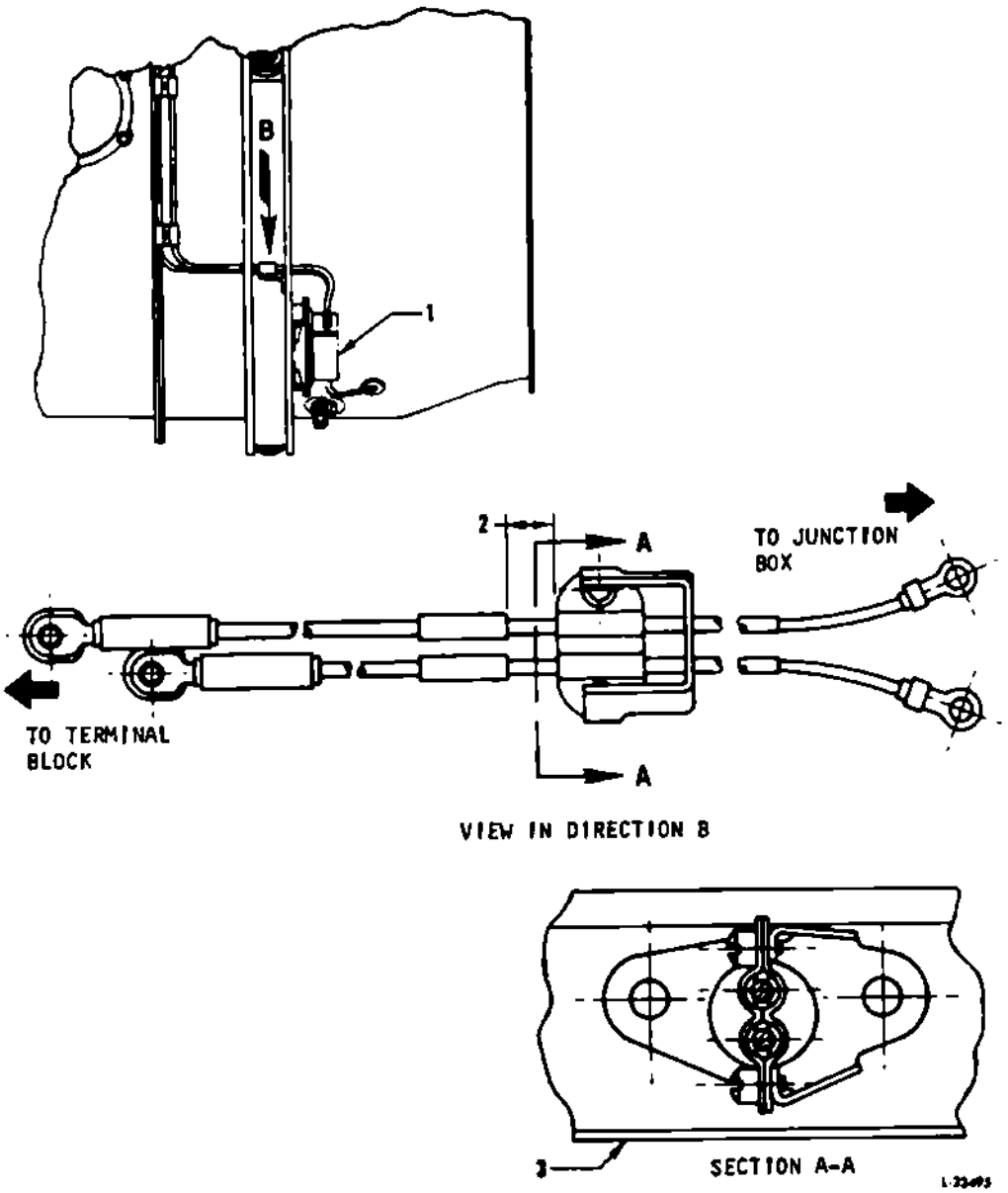
NOTE: To aid assembly and reduce cracking of lead insulation, remove bracket on dual wire leads before installing through exhaust case mount flanges. (For engines incorporating SB 1647). See Figure 401.

(a) For engines incorporating SB 1647, attach leads to terminals at output end of junction box. If bus bar has been removed, install over lugs, attach leads, and secure with nuts. Torque nuts to Chapter/Section 72-00-00, Inspection/Check-02 "Fits And Clearances", References 111 and 112. See Figure 402.

(b) For engines so equipped, plug lead connector into cable connector and secure with coupling nut (and bolts, if applicable).

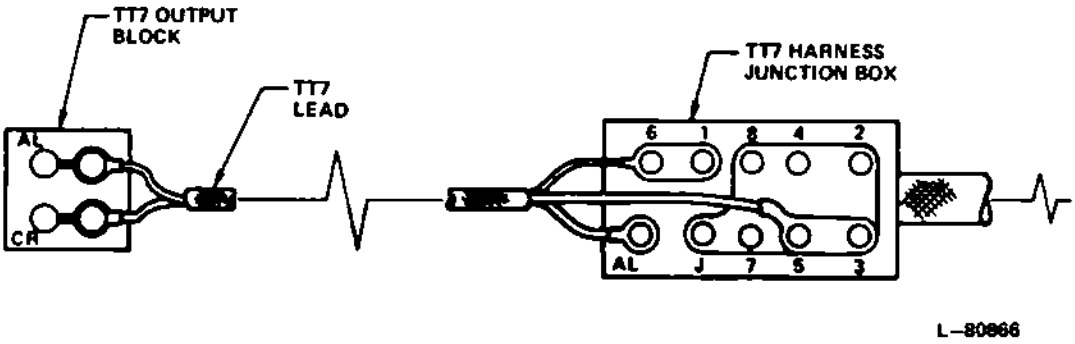
NOTE: Ensure electrical contacts in connectors are clean.

(c) Attach forward ends of leads to terminal board and secure. Proper installation of PN 558987 and 558988 type terminal nuts requires that the cylindrical grooved portion of nut must head the way onto the stud. Torque to Section 72-00-00, Inspection/Check-02 Fits And Clearances, References 106 and 108.



1. Junction Box
2. 0.600 - 0.800 Inch
3. Turbine Exhaust Outer Duct Mounting Rails

Thermocouple Lead Installation
(Incorporating SB 1647)
Figure 401
(Task 77-22-01-450-001)



Thermocouple Box And Cable
(Boost Circuit Type)
Figure 402
(Task 77-22-01-450-001)

THERMOCOUPLE LEAD AND CABLE - INSPECTION/CHECK-00

Task 77-22-01-210-001:

1. Periodic Inspection

A. General

(1) Inspect thermocouple cable and lead assemblies for evidence of mechanical damage to stainless steel braid, glass fiber sleeving, teflon coating (if so equipped), and terminals. Check for rupture or severe fraying, and for broken conductor strands at any terminal.

Task 77-22-01-750-001:

2. Electrical Checks

See Figures 601 through 606.

A. General

(1) The validity of electrical tests made in the field may depend upon limitations inherent in the common ohmmeter. This instrument is not dependable for determining the exact wire resistances of the thermocouple cable. It may, however, be used to detect gross failures such as open or intermittent circuits, and metal-to-metal short circuits. Also, approximate insulation resistance may be checked if certain precautions are observed. The ohmmeter used in the following tests must be of good quality and in good condition; i.e. free from "stickness" of the meter needle, with pinjacks firm, test leads sound, and dry cells in condition to permit full-scale deflection for all positions of the range switch.

B. Thermocouple Integrity Check

(1) To check the averaging circuit, place a soldering copper of at least 500 watts capacity in contact with one of the thermocouples. Observe the cockpit instrument for a deflection of the needle thereby proving continuity. Allow a sufficient period of time to elapse for the instrument needle to show a decrease in reading; then repeat the procedure with successive thermocouples until all of them have been checked.

NOTE: This is not intended as a calibration check of the thermocouple. Application of heat during functional test, in many instances, causes wire to thermally change dimensions. If thermocouple circuit is cracked, circuit may

become discontinuous and millivolt output will drop to zero. This condition cannot be readily detected by loop resistance and insulation checks at ambient temperature.

C. Continuity Check

(1) Set ohmmeter range switch to a range which has center scale value of approximately ten ohms.

NOTE: Broken wires which come into contact intermittently due to flexing will cause needle to fluctuate. False intermittent indications will result if ohmmeter prods are not in firm contact with clean terminals; also, if ohmmeter prods, leads, or jacks are defective.

(2) Do a continuity check in accordance with schematic. For engine incorporating SB 1647 perform continuity check on cable assembly and single wire leads.

(3) Reject any assembly for discontinuity.

D. Insulation Resistance Check

NOTE: Insulation resistance check is optional for thermocouple cables incorporating SB 1647. Thermocouple leads are not applicable due to absence of steel braid.

(1) Make sure that the thermocouple cable and leads are properly installed and connected.

NOTE: Insulation resistance values slightly below the limits set forth below will not result in a defective EGT system. It does, however, clearly indicate that the insulation is deteriorating and will result in eventual shorts or deficient EGT readings. Therefore, EGT system components with insulation resistance readings below the limits set forth require attention to restore the insulation resistance to acceptable values and prevent further deterioration and EGT system failure.

(2) Use a low voltage ohmmeter and check insulation for short circuits, excessive leakage, and internal insulation chafing discrepancies. Check proper operation of instrument by touching test prods together and noting needle deflection to read zero ohms.

NOTE: Low voltage ohmmeter utilizing less than 40 volts (dc) and maintained at an accuracy of five percent must be used for determining insulation resistance. Megger or other high voltage test must not be used under any circumstances. For thermocouple cables incorporating SB 1647, values can be obtained by placing one prod in contact with braided metal shield of cable to the probes, and other prod in contact with junction box terminal after removing the box cover.

(3) Place one prod in contact with the cable steel wire braid covering and other prod in contact with alumel conductor.

(4) Read the Ohmmeter. If the resistance that is recorded is below 50,000 ohms, proceed as follows: If full-scale deflection (zero ohms) is recorded, and no terminals are in accidental contact, reject part. If large (but not full-scale) deflection is recorded, presence of carbon or excessive moisture may be indicated. Carbon yields fairly steady reading. Moisture tends to produce readings which waver or drift after five to 30 seconds. If presence of moisture is indicated, bake cable at 93 - 121°C (200 - 250°F) for one hour and recheck.

NOTE: False drift may be due to variations in applied voltage. To check for false drift, place prods in contact with each other for ten seconds. Readings must not wander from full-scale deflection.

(5) Repeat steps (2), (3), and (4) with one prod in contact with cable steel wire braid covering and other in contact with chromel conductor.

(6) Perform resistance check of insulation between conductors, using low voltage ohmmeter. Place one prod on chromel terminal and other on alumel terminal. If resistance recorded is below 50,000 ohms, reject part.

(7) Repeat steps (2), (3), (4), (5), and (6) above for thermocouple front cable, if applicable.

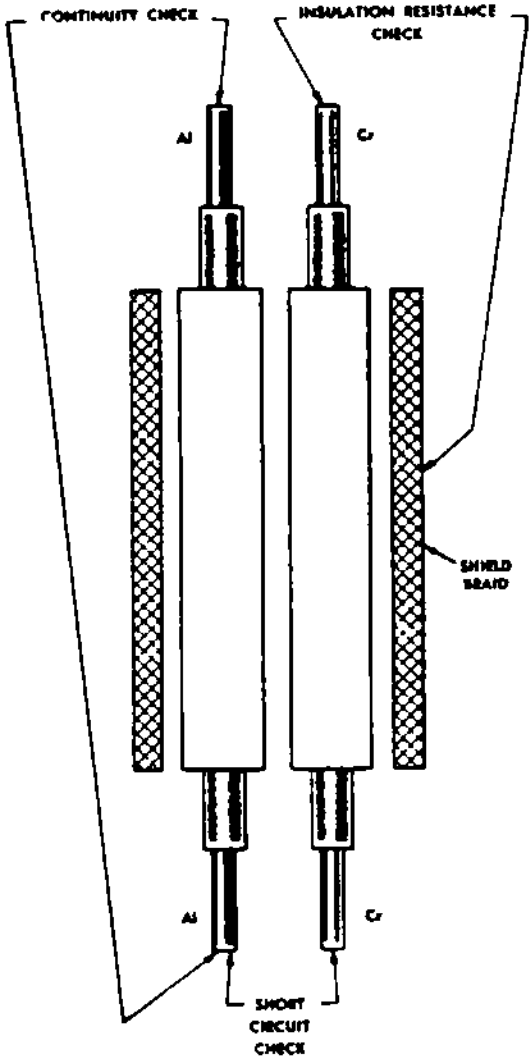
E. Short Circuit Check

(1) Set ohmmeter range switch to a range which has center scale value of approximately ten ohms.

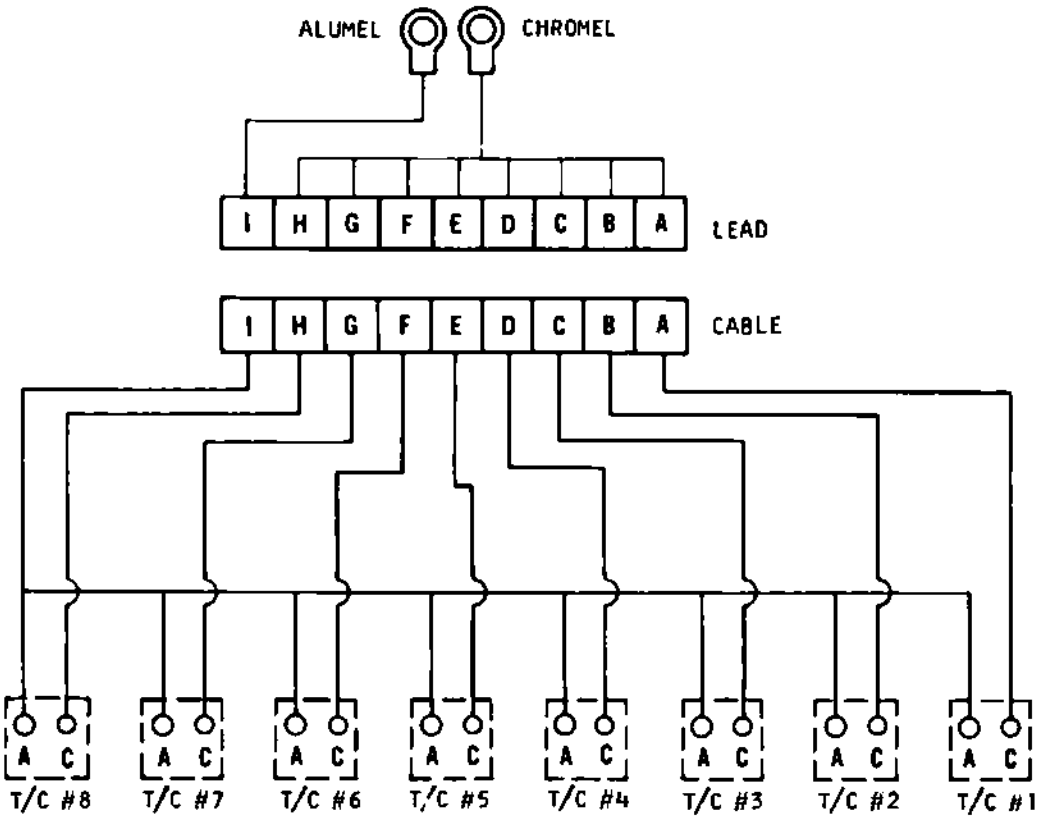
(2) Place one prod in good contact with well-cleaned alumel terminal and other in good contact with well-cleaned chromel terminal. Flex cable gently and observe instrument needle. If any deflection results (unless caused by accidental contact between other terminals of cable), reject part.

NOTE: If junction box is used, cover must be removed to expose terminals.

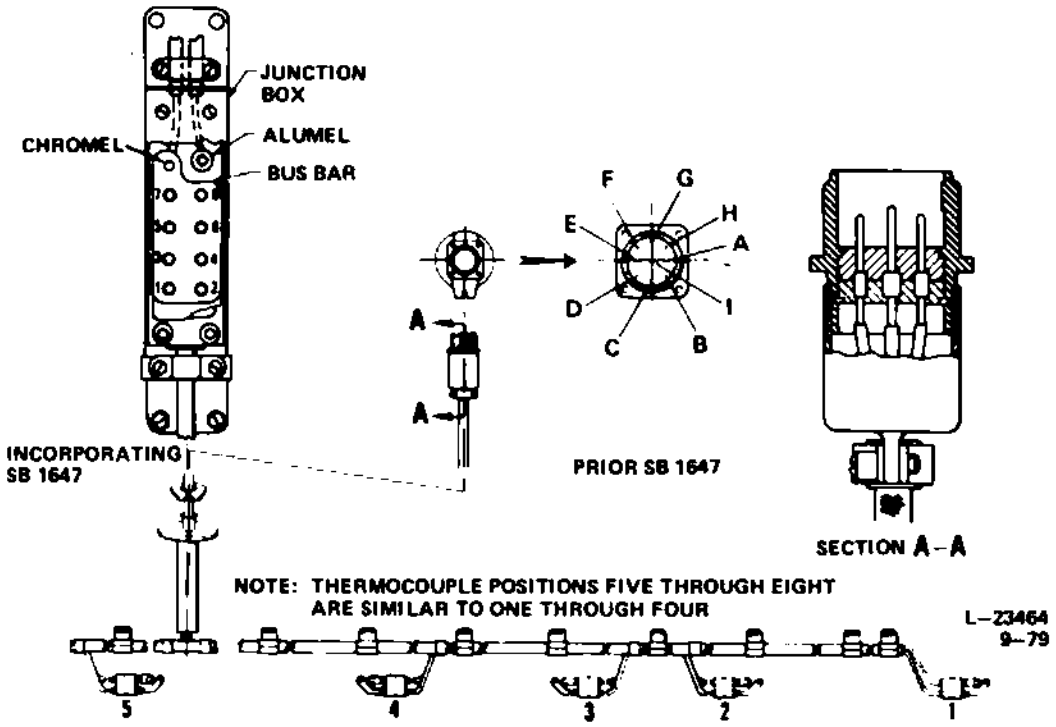
(3) Repeat steps (1) and (2) for thermocouple front cable if applicable.



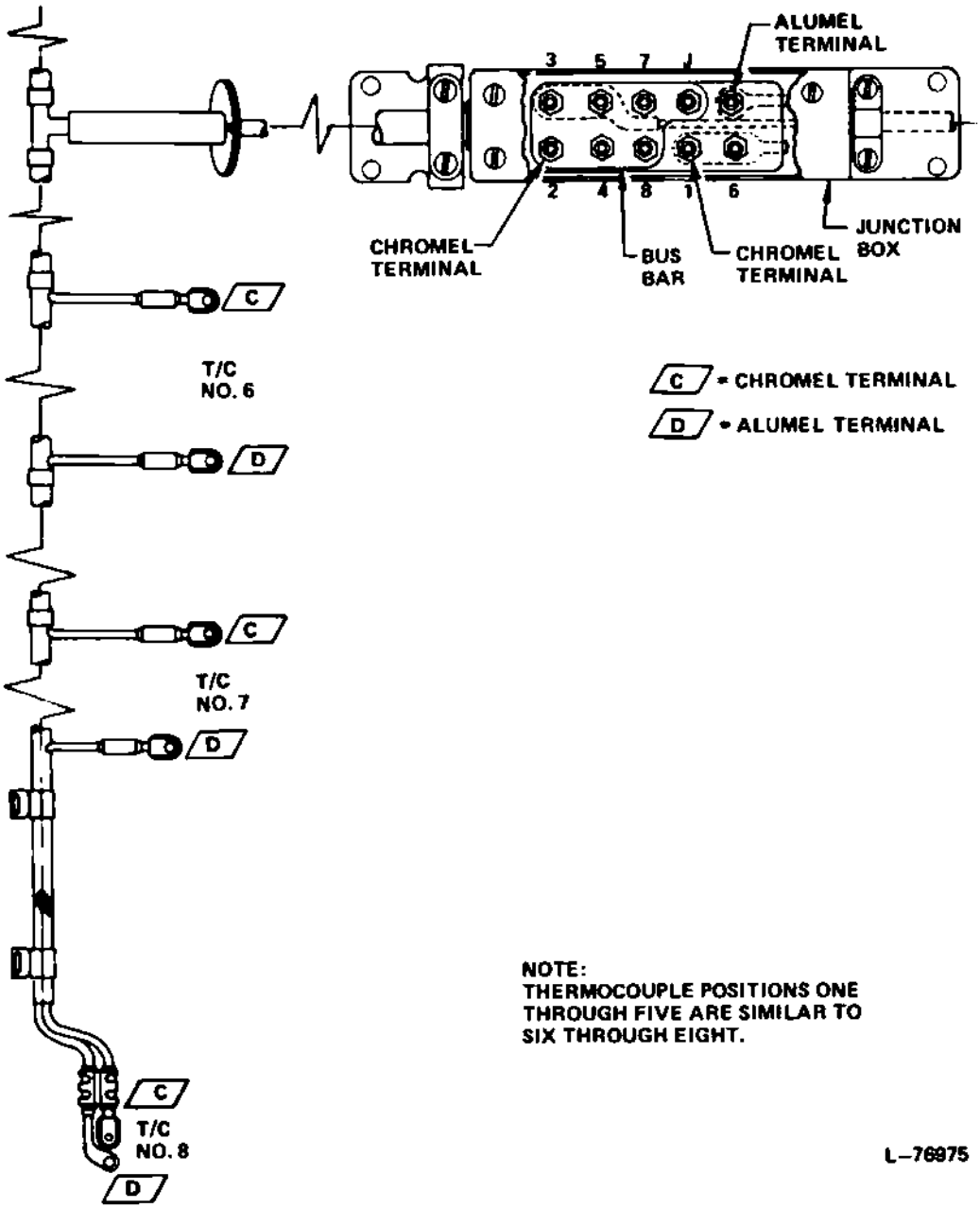
Test Schematic
Figure 601
(Task 77-22-01-750-001)



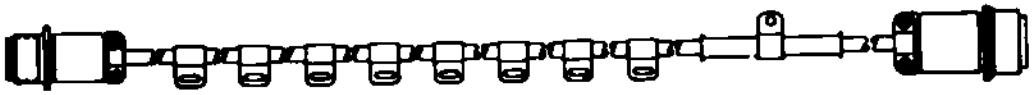
Thermocouple Lead and Cable
Schematic (Prior to SB 1647)
Figure 602
(Task 77-22-01-750-001)

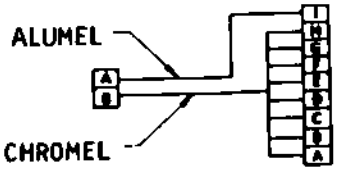


Thermocouple Cable
Figure 603 (Sheet 1)
(Task 77-22-01-750-001)



Thermocouple Box And Cable
Assembly (Boost Circuit Type)
Figure 603 (Sheet 2)
(Task 77-22-01-750-001)

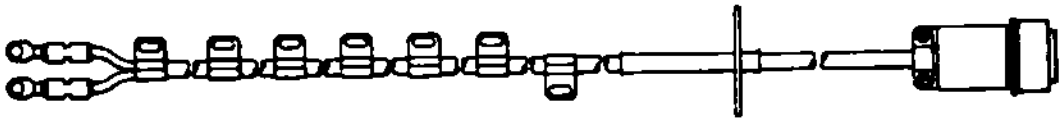


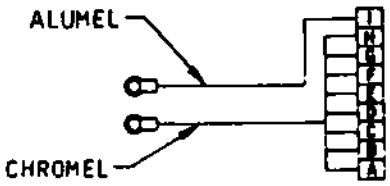


WIRING DIAGRAM

1-14428
6-72

Special Purpose Thermocouple
Lead (For French Engines Only)
Figure 604 (Sheet 1)
(Task 77-22-01-750-001)

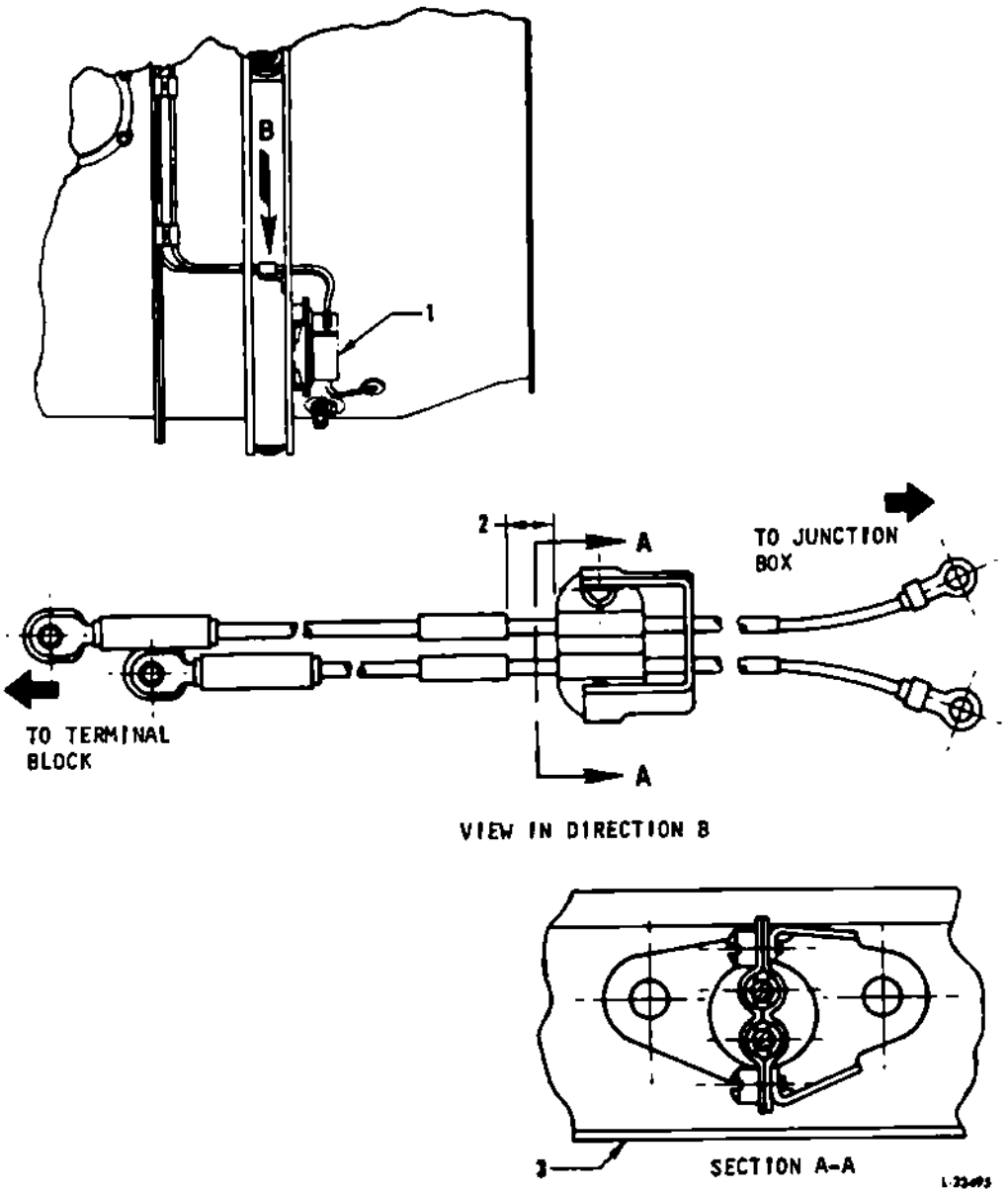




WIRING DIAGRAM

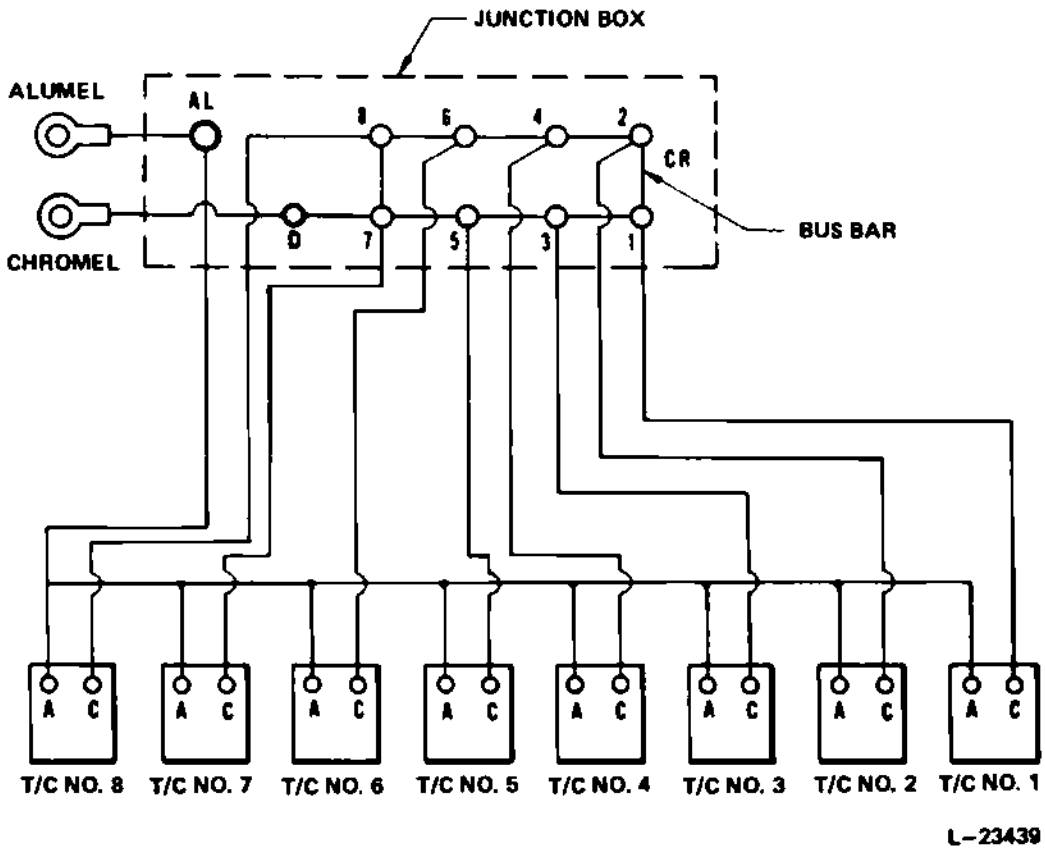
L 23537

Special Purpose Thermocouple
Lead (Prior to SB 1647)
Figure 604 (Sheet 2)
(Task 77-22-01-750-001)

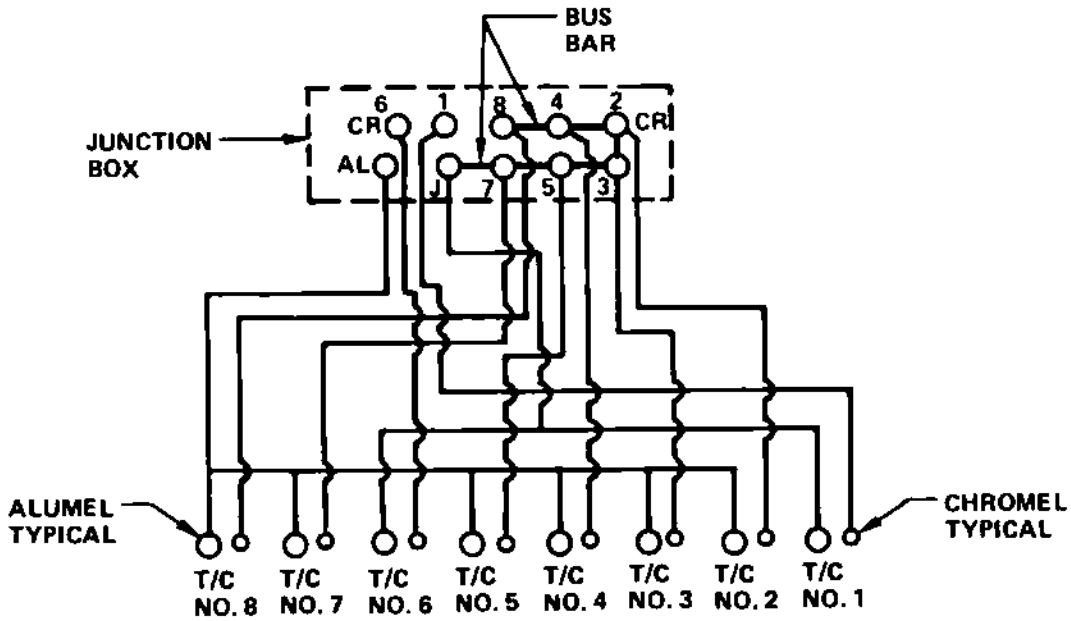


1. Junction Box
2. 0.600 to 0.800 Inch
3. Turbine Exhaust Outer Duct Mounting Rails

Thermocouple Lead
(Incorporating SB 1647)
Figure 605
(Task 77-22-01-750-001)



Thermocouple Lead and Cable
Schematic (Incorporating SB 1647)
Figure 606 (Sheet 1)
(Task 77-22-01-750-001)



Thermocouple Lead and Cable
Schematic (Boost Circuit Type)
Figure 606 (Sheet 2)
(Task 77-22-01-750-001)

THERMOCOUPLE LEAD AND CABLE - CLEANING/PAINTING-00

Task 77-22-01-110-001:

1. Cleaning of Thermocouple Cable

   A. Cleaning

      (1) Clean external surfaces by wiping with cloth moist with SPOP 208 solvent. See Chapter/Section 70-00-00, Standard Practices-00.

      CAUTION: NO FOREIGN MATERIAL MUST REMAIN ON THE TERMINALS.

      (2) If necessary, clean all terminal contact surfaces by SPOP 6. See Chapter/Section 70-00-00, Standard Practices-00.

Task 77-22-01-300-001:

1. Thermocouple Cable Braided Shield Repair

A. Equipment And Materials Necessary - None

B. Procedure

(1) Repair damage to the braided shield on the thermocouple cable by Chapter/Section 70-00-00, Standard Practices.

79-00-00

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79–11–01	OIL TANK – REMOVAL/INSTALLATION–00 • 79–11–01–450–001: Removal/Installation of Engine Oil Tank
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79–22–01	FUEL COOLANT OIL COOLER – DESCRIPTION–00 • 79–22–01–990–001: Fuel Coolant Oil Cooler – Description and Operation
79–22–01	FUEL COOLANT OIL COOLER – REMOVAL/INSTALLATION–00 • 79–22–01–450–001: Removal/Installation of Fuel Coolant Oil Cooler. • 79–22–01–450–002: Removal/Installation of Oil Cooler Connector • 79–22–01–450–003: Removal/Installation of the Oil Cooler Fuel Inlet Tube Connector • 79–22–01–450–004: Oil Cooler Bypass Valve Removal/Installation
79–22–01	FUEL COOLANT OIL COOLER – INSPECTION/CHECK–00 • 79–22–01–210–001: Oil Cooler Bypass Valve
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OIL SYSTEM - DESCRIPTION-00

Task 79-00-00-990-001:

1. General

A. Engine Lubrication System

(1) The engine lubrication system is of a self-contained high pressure design consisting of a pressure system which supplies lubrication to the main engine bearings and to the accessory drives, and a scavenge system by which oil is withdrawn from the bearing compartments, and from the accessories, and then returned to the oil tank. A breather system connecting the individual bearing compartments and the oil tank completes the oil system. For a complete description of the engine oil system refer to Chapter 72-00-00, Task 72-00-00-990-014, Description.

Pratt & Whitney
JT8D MAINTENANCE MANUAL (PN 481671)

Please insert the revised pages into this manual and delete obsoleted pages in accordance with the following List of Effective Pages. Revised pages are indicated by the letter "R", added pages by the letter "A", and deleted pages by the letter "D". Superseded pages shall be removed and destroyed.

The List of Effective Pages records not only each page of subject revision but also each previously issued page which is still current. Blank pages and pages which are no longer current do not appear on this list. If there is any question about the currency of the maintained copy, it is recommended that each page of the manual be checked off against this List of Effective Pages. Any page which does not check out with this list, either by number or by date, shall be discarded. This list is reissued in its entirety whenever this manual section is revised.

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List of Effective Pages - 79 - Oil
See end of list.

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TO: RECIPIENTS OF JT8D MAINTENANCE MANUAL, PART NUMBER 481671

REVISION NO. 127 DATED APRIL 15, 2004

HIGHLIGHTS - 79 - OIL

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OIL TANK - DESCRIPTION-00

Task 79-11-01-990-001:

1. Description and Operation of the Oil Tank

A. The Engine Oil Tank

(1) The engine is provided with a cylindrical-shaped oil tank which mounts on the left front face of the gearbox and is secured at the front with a strap. The oil filter is located in a sump cavity and is provided with a self-locking cap and dip stick gage. The dip stick is connected to the cap by two pins. The sump cavity is provided with a drain connection for attaching a drain line overboard. The tank is equipped with a filler strainer and, in the bottom, an outlet strainer.

(2) The tank is constructed of stainless steel. This material is capable of withstanding, without permanent deformation, the stresses imposed by pressure, vibration, and shock loads such as may occur during landing, rough flight conditions, etc. A baffle serves to minimize sloshing of the oil in the tank.

(3) This oil tank when installed in a normal position on an unrotated engine holds a total of 5.0 U.S. gallons, and the usable quantity of oil is about 4.0 U. S. gallons. The oil deaerator is an integral part of the oil tank.

(4) The oil tank is provided with three indicator bosses. One, a quantity indicator, is located at the bottom of the tank. The other two bosses, one a minimum level indicator and the other a full level indicator, are located on the outer wall of the tank.

(5) Short, straight oil and breather transfer tubes with packings accommodate the oil flow between the tank and the gearbox.

Task 79-11-01-450-001:

1. Removal/Installation of Engine Oil Tank

A. Removal

(1) Drain oil from tank prior to removal by opening drain valve on bottom of tank.

(2) Remove locknuts holding tank to gearbox.

(3) While supporting tank, remove locknut from tank strap turnbuckle and open strap.

(4) Pull tank straight forward off gearbox studs and remove from engine.

CAUTION: USE CARE TO AVOID DAMAGE TO TRANSFER TUBES BETWEEN TANK AND GEARBOX.

(5) Remove three transfer tubes and cover openings.

(6) Unfasten cotterpins and remove strap retaining pins from engine flange. Remove oil tank strap.

B. Installation

(1) Install oil tank strap on engine at Flange C, securing with retaining pins, washers, and cotterpins at two locations. Bend cotterpins to secure.

(2) Install grommet and bushing in each of three oil tank lugs.

(3) Install four new packings on each of three straight transfer tubes. Coat packings lightly with engine oil.

(4) Install three transfer tubes in their openings in front of gearbox.

(5) Position tank, drain valve down, in front of gearbox. Move rearward into position, engaging bushings over studs and mating tubes with openings in rear of tank.

CAUTION: USE EXTREME CARE TO AVOID DAMAGING OR DISRUPTING TUBES AND/OR PACKINGS.

(6) Install flat washer and locknuts on three studs. Torque locknuts evenly.

(7) Wrap oil tank strap around tank.

(8) Install spherical washer and locknut on strap turnbuckle bolt and tighten to torque indicated by Chapter/Section 72-60-00 Inspection/Check-00 Fits and Clearances, Reference Number 1475.

NOTE: For engines incorporating two piece construction strap, spherical washer is not required.

(9) Close oil tank drain valve and refill tank to correct level.

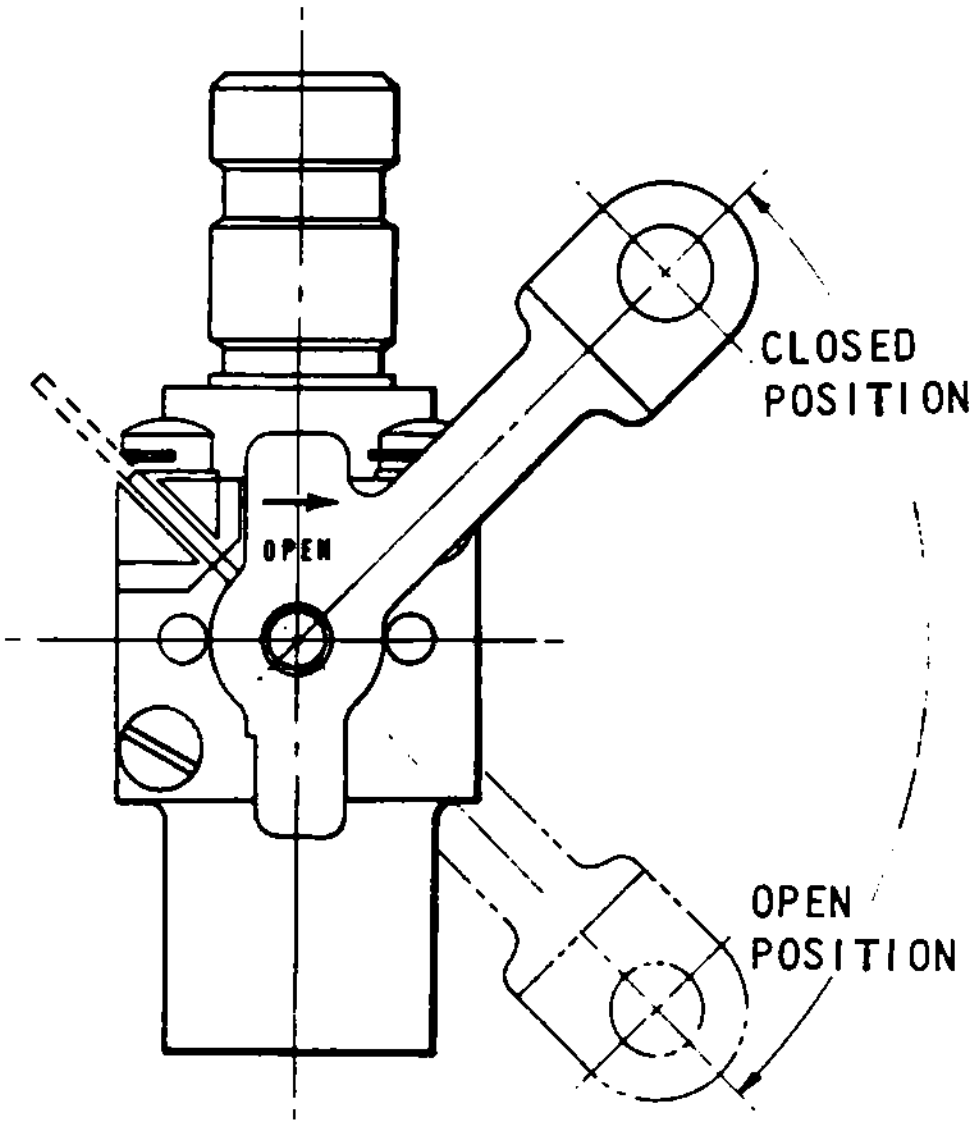
OIL TANK DRAIN VALVE - DESCRIPTION-00

Task 79-21-01-990-001:

1. Description and Operation of the Oil Tank Drain Valve

A. Oil Tank Drain Valve
See Figure 1.

(1) The oil tank drain valve is located at the bottom of the oil tank. The handle is spring loaded to the valve closed position. Manually rotating the handle ninety degrees in a clockwise direction opens the valve allowing the oil to drain from the tank. The handle is locked in the valve open position by a ball detent arrangement. Counterclockwise movement of the handle unseats the balls from the detents and allows the spring tension to return the handle to the valve closed position.



Oil Tank Drain Valve
Figure 1
(Task 79-21-01-990-001)

OIL TANK DRAIN VALVE - REMOVAL/INSTALLATION-00

Task 79-21-01-450-001:

1. Removal/Installation of the Oil Tank Drain Valve

   A. Removal

      (1) Drain oil from tank.

      (2) Loosen check nut on drain valve.

      (3) Remove drain valve from boss insert on bottom of tank.

   B. Installation

      (1) Install the check nut on the drain valve with the counterbored face of the nut away from the body of the valve.

      (2) Install a new backup ring into the counterbored face of the nut, then install a new packing (lubricated with PWA 36500 Assembly fluid) against the backup ring. Adjust the nut, ring, and and packing.

      (3) Insert the drain valve into the drain boss insert on the bottom of the tank and turn until the packing touches the boss.

      (4) Adjust the position of the valve, then tighten the check nut to the recommended torque and lockwire.

FUEL COOLANT OIL COOLER - DESCRIPTION-00

Task 79-22-01-990-001:

1. Fuel Coolant Oil Cooler - Description and Operation

A. Description

(1) The fuel oil cooler is of the full flow type with a pressure bypass feature. The cooler is mounted on the lower left side of the front compressor case. It consists of a housing containing a removable core composed of more than 200 soda straw-like tubes through which fuel passes; a series of baffles within the core which direct the flow of oil around the tubes; and a bypass valve which permits oil flow to the main bearing compartments in the event of core clogging.

B. Operation

(1) The oil leaves the oil pressure pump in the gearbox and flows to the fuel oil cooler. The oil flows through the cooler directed by baffles to flow around the tubes through which fuel flows. Heat from the oil is transferred through the tube walls to the fuel. If the cooler becomes clogged, the oil bypass valve opens to permit the continuous flow of oil. Oil leaves the cooler and flows through the oil pressure tubing to the main bearing compartments.

FUEL COOLANT OIL COOLER - REMOVAL/INSTALLATION-00

Task 79-22-01-450-001:

1. Removal/Installation of Fuel Coolant Oil Cooler.

A. Removal. See Figure 401.

(1) Disconnect cooler-to-oil pressure relief valve tube at connector on front of oil cooler.

(2) Disconnect main bearing oil pressure tubing at connector both in front of and to rear of oil cooler outlet connector.

(3) Disconnect gearbox-to-oil cooler tube at elbow on top rear of oil cooler.

(4) Unfasten nuts holding fuel tube retaining plate at rear of oil cooler and slide plate rearward.

(5) At top right side of oil cooler fuel inlet connector, remove nuts that secure connector to engine bracket.

(6) At the rear of oil cooler remove bolts that secure cooler to engine bracket.

(7) Carefully remove oil cooler (and flowmeter if attached) by easing it forward and off oil cooler-to-pressurizing and dump valve tube.

B. Installation. See Figure 401.

(1) Position new seal on oil cooler-to-pressurizing and dump valve tube. Position oil cooler (and flowmeter if attached) on engine and carefully move oil cooler rearward to join oil cooler-to-pressurizing and dump valve tube.

(2) Connect oil cooler fuel inlet connector to engine bracket using nuts and washers.

(3) Secure oil cooler to engine bracket located at rear of oil cooler using bolts and lockwire.

(4) Slide plate forward and, using three nuts, fasten oil cooler-to-pressurizing and dump valve tube at rear of oil cooler.

(5) Using new packing (lubricated with PWA 36500 Assembly Fluid) and retainer, install cooler-to-oil pressure relief valve tube at connector at front of oil cooler.

(6) Connect No. 1 bearing external oil pressure tube with retainer and new packing (lubricated with PWA 36500 Assembly Fluid) at front of oil cooler.

(7) Connect main bearing oil pressure manifold using new packing and retainer at rear of oil cooler outlet connector.

(8) Connect gearbox-to-oil cooler tube using new packing (lubricated with PWA 36500 Assembly Fluid), retainer, ferrule and nut at elbow on top rear of oil cooler.

(9) Torque and lockwire all tube nuts.

Task 79-22-01-450-002:

2. Removal/Installation of Oil Cooler Connector

A. Removal. See Figure 401.

(1) Unfasten oil pressure compressor front bearing external tube at connector on top of oil cooler.

(2) Unfasten oil pressure main bearing manifold at rear of connector on top of oil cooler.

(3) Remove connector from oil cooler.

B. Installation. See Figure 401.

(1) Position connector on oil cooler and secure connector to cooler using new packing (lubricated with PWA 36500 Assembly Fluid) and two nuts. Torque nuts.

(2) Secure oil pressure main bearing manifold to rear of connector on top of oil cooler using retainer, new packing (lubricated with PWA 36500 Assembly Fluid) and nut. Torque nut to Fits and Clearances, Reference 101 Chapter/Section 72-00-00, Inspection/Check-02 and lockwire.

(3) Secure oil pressure compressor front bearing external tube to connector using retainer, new packing (lubricated with PWA 36500 Assembly Fluid) and nut. Torque and lockwire.

Task 79-22-01-450-003:

3. Removal/Installation of the Oil Cooler Fuel Inlet Tube Connector

A. Removal. See Figure 401.

(1) Remove nuts, bolts and washers, at front end of oil cooler connector.

(2) Remove bolts and washers at fuel flowmeter.

(3) Remove oil cooler fuel inlet tube connector.

B. Installation. See Figure 401.

NOTE: Torque connector to Section 72-00-00, Inspection/Check-02 Reference 117 prior to installation of oil cooler fuel inlet tube connector.

(1) Position oil cooler fuel inlet tube connector on engine and secure to fuel flowmeter using bolts and washers. Torque bolts.

(2) Secure upper end of connector to oil cooler using a new seal, nuts, bolts, and washers. Torque bolts.

Task 79-22-01-450-004:

4. Oil Cooler Bypass Valve Removal/Installation

See Figure 401.

A. Removal/Disassembly

(1) Remove locknuts and washers and remove bypass valve cover.

(2) Remove bypass valve assembly from valve cavity in oil cooler housing.

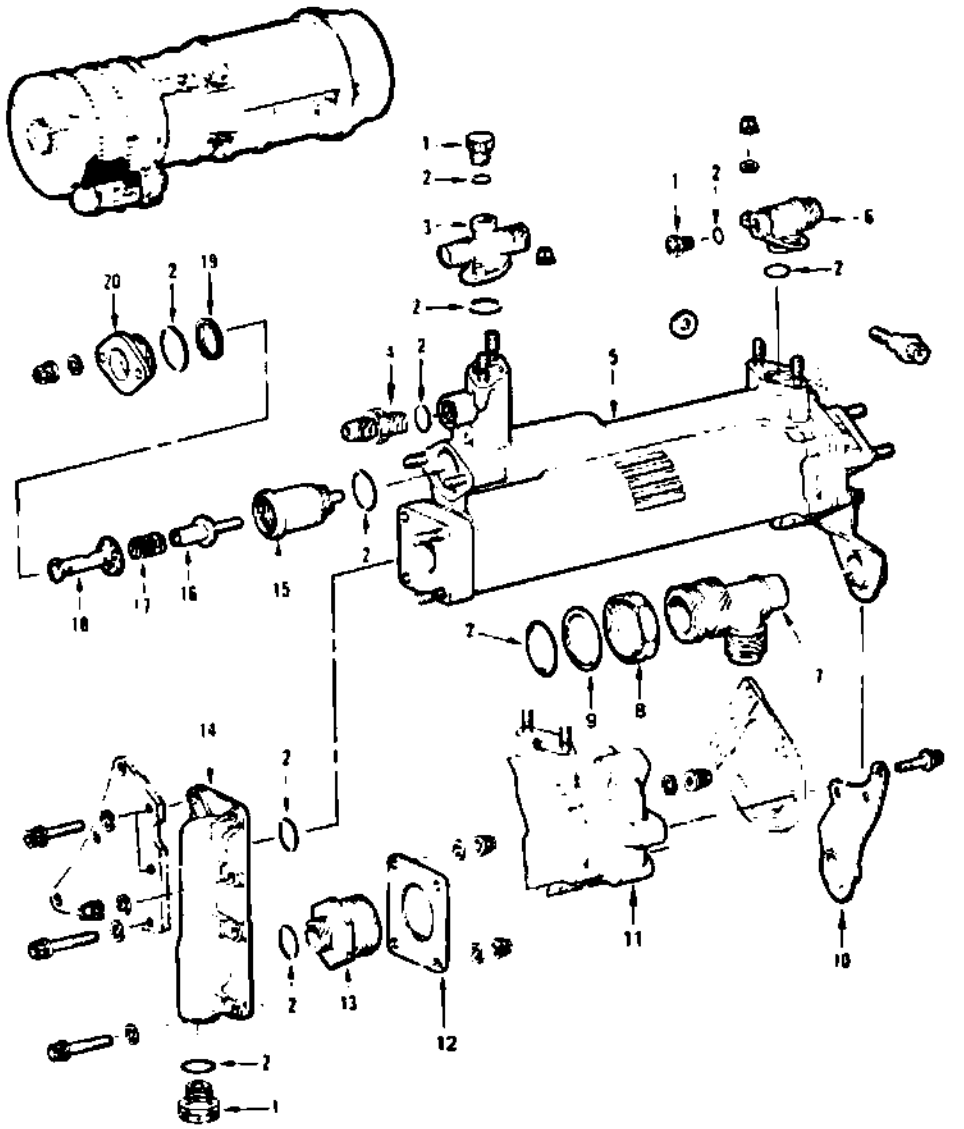
(3) Remove retaining ring and separate spring seat, spring, and valve from bypass valve seat.

B. Assembly/Installation

(1) Assemble valve, spring, and spring seat inside bypass valve seat and secure with retaining ring.

(2) Install new packing on bypass valve assembly and install valve assembly in oil cooler housing.

(3) Install cover, with new packing (lubricated with PWA 36500 Assembly FLuid) on valve cavity and secure with washers and nuts.



Fuel-Oil Cooler/Bypass
Valve Removal/Installation
Figure 401
(Task 79-22-01-450-004)

1. Hex Plug
2. Packing
3. Oil Cooler-Out Tube Connector
4. Connector
5. Oil Cooler Housing
6. Oil Cooler Inlet Tee
7. Flowmeter Inlet Adapter Connector
8. Flowmeter Boss Connection Hex Nut
9. Backup Ring
10. Flowmeter Rear Bracket (For Use With Index 11 Oil Cooler Assembly)
11. Oil Cooler Housing (Incorporating SB 1640)
12. Flowmeter Adapter Lock Plate
13. Tube Connector
14. Oil Cooler Fuel Inlet Tube Connector
15. Bypass Valve Seat
16. Bypass Valve
17. Spring
18. Spring Seat
19. Retaining Ring
20. Packing Cover

NOTE: Fuel oil cooler of short-cover type (prior to SB 1640) which is modified to fit long-cover type engine brackets (by SB 1640) will have spacer fitting over cover.

Key to Figure 401

FUEL COOLANT OIL COOLER - INSPECTION/CHECK-00

Task 79-22-01-210-001:

1. Oil Cooler Bypass Valve

   A. Inspection

      (1) Inspect seating and sealing surfaces of bypass valve, valve seat, and spring seat which could impair function or sealing.

FUEL COOLANT OIL COOLER - CLEANING/PAINTING-00

Task 79-22-01-110-001:

1. Oil Cooler Bypass Valve

   A. Cleaning

      (1) Clean all bypass valve parts by SPOP 208 and dry with compressed air. See Chapter/Section 70-00-00,Standard Practices Manual, PN 585005.

EXTERNAL OIL TUBES - REMOVAL/INSTALLATION-00

Task 79-23-01-450-001:

1. Removal/Installation of the Pressure Oil External Tubes

A. Removal

(1) Mark location of supporting clips and brackets to facilitate proper reinstallation.

(2) Remove support clips, then disconnect and remove the No. 6 external oil pressure tube from rear left side of engine.

(3) Disconnect and remove No. 2 and 3 bearings external oil pressure tube from between main bearing oil pressure manifold and gearbox upper rear elbow.

(4) Disconnect and remove main bearing oil pressure manifold from left side of engine.

(5) Disconnect and remove No. 1 bearing external oil pressure tube from between oil cooler outlet connector and the adapter at bottom of the inlet case.

B. Installation

(1) Using new packings (lubricated with PWA 36500 Assembly Fluid) retainers, ferrules and backup rings as indicated, install following pressure oil external tubes:

(a) No. 1 bearing external oil pressure tube between oil cooler outlet connector and inlet case tubes adapter, bottom of inlet case (retainer and packing at each end).

(b) Main bearing oil pressure manifold, left side of the engine (packing and retainer at oil cooler outlet connector, packing and retainer at diffuser outer duct center elbow).

(c) No. 2 and 3 bearings external oil pressure tube between main bearing manifold and gearbox upper rear elbow (nut, packing, and retainer at the brazed ferrule end; nut, ferrule, packing, and retainer at other end).

(d) No. 6 bearing external oil pressure tubes, rear left side of engine (retainer and packing at each end).

(2) Tighten all tube nuts to recommended torque. Lockwire nuts.

(3) Reinstall clips and brackets. Secure with screws.

Task 79-23-01-450-002:

2. Removal/Installation of Scavenge Oil External Tubes

A. Removal

(1) Remove following scavenge oil tubes from engine.

(a) No. 1 bearing oil tube from lower side of engine.

(b) No. 4 bearing oil tube from between gearbox and lower left side of engine.

B. Installation

(1) Using new retainers, packing and ferrules as indicated, install following scavenge oil tubes:

NOTE: For engines not equipped with chip detector, but having a tee fitting on gearbox end, install packing and plug. Lockwire plug.

(a) No. 1 bearing oil tube - use two retainers and two packings. Torque and lockwire nuts.

(b) No. 4 bearing oil tube - Use a ferrule, packing, and retainer. Torque and lockwire nut.

NOTE: If the engine is installed in a Boeing 727 and the engine does not have SB 5945 and SB 5514 (Revision 7 or subsequent) parts, make sure there are two temperature indicators attached correctly. It must be possible to see the indicators when the tube is installed on the engine. Do the inspection procedures in ASB 5944 or in SB 6101, as applicable.

Task 79-23-01-450-003:

3. Removal/Installation of the Oil Breather External Tubes

A. Removal

(1) Remove all clips and/or brackets.

(2) Remove following breather tubes from engine:

(a) Breather front tube (lower left side of engine).

(b) Breather rear bearing tube (left side, gearbox to diffuser case outer duct).

B. Installation

(1) Using new packings (lubricated with PWA 36500 Assembly Fluid) and retainers as indicated, install the following breather tubes as follows:

(a) Fasten breather front tube at six o'clock position on front compressor inlet case using packing and retainer. Fasten other end at gearbox using packing and retainer then torque and lockwire nut.

(b) Connect breather rear bearing tube on diffuser outer duct using a new packing, a plate, two washers, two bolts and nuts. Torque and lockwire nuts.

(c) Fasten outer end of rear bearing tube to gearbox using a ferrule, packing, retainer and nut. Tighten nut to torque indicated by Fits and Clearances, Reference 104, Chapter/Section 72-00-00, Inspection/Check-02 and lockwire.

(d) Secure all clips and brackets to the breather tube assemblies with screws.

Task 79-23-01-450-004:

4. Removal/Installation of Oil Cooler-to-Oil Pressure Relief Valve Tube

A. Removal

(1) Remove all clips and brackets.

(2) Disconnect tube at oil cooler connector (left side) and at tube connection on rear side of gearbox.

B. Installation

(1) Using new packing (lubricated with PWA 36500 Assembly Fluid) and retainer, install cooler to oil pressure relief valve tube at oil cooler strainer (left side of engine 7 o'clock position).

(2) Secure other end to elbow at rear of gearbox at pressure relief valve using a new packing (lubricated with PWA 36500 Assembly Fluid) and retainer.

(3) Tighten to recommended torque and lockwire.

Task 79-23-01-450-005:

5. Removal/Installation of the Gearbox-to-Oil Cooler Tube

A. Removal

(1) Remove all clips and brackets.

(2) Disconnect oil cooler tube at gearbox end and at oil cooler end.

B. Installation

(1) Install oil cooler tube at oil cooler using ferrule, new packing (lubricated with PWA 36500 Assembly Fluid) and retainer, and nut.

(2) Torque and lockwire nut.

(3) Install oil cooler tube at gearbox end using a new packing (lubricated with PWA 36500 Assembly Fluid) and two bolts.

(4) Torque and lockwire bolts.